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CONTENTS

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EDITORIAL

SELECTIVE LOGGING

ALMOST overnight "selective logging" has become a phrase to conjure with. Does the forester wish to prove that he is no academic theorist but a practical business man? Let him advocate selective logging. Does the lumberman wish to demonstrate his ardent belief in forest perpetuation rather than forest destruction? Let him claim to be practising selective logging. Originally coined for the eminently desirable but strictly limited purpose of indicating that silviculture, with its emphasis on the careful selection of trees to be cut, and utilization, with its emphasis on logging, are inseparable parts of forest management, the phrase has attained a popularity which bids fair to result in its coming to mean all things to all men.

Perhaps the nearest approach to an official definition of the new term is Major Stuart's statement in the foreword to "Selective Logging in the Northern Hardwoods of the Lake States" that, as used by the authors of that bulletin, it "denotes a partial cutting practice which, by a judicious selection of the trees to be removed, meets both the silvicultural and present economic requirements, in such a way as to perpetuate and improve the forest and at the same time maintain or increase the profits to the owner." This is clear cut, logical, and limited. It presents no new ideas but rather a shifting of emphasis.

Both foresters and lumbermen have long been familiar with selective logging not only in theory but in practice. The selection method of cutting a forest to obtain natural reproduction is taught in every forest school; partial cutting has been a common woods operation since logging first began. The difficulty has been that silvicultural theory and logging practice have not always mixed. "Selective logging," both as a concept and a phrase, will be of permanent value to the extent, and only to the extent, that it succeeds in bringing the two together.

Foresters need to realize, more perhaps than they have in the past, that silviculture cannot be practised in an economic vacuum. Just what rate of return the owner may legitimately expect on his forest investment may be open to question; but that silvicultural measures must be judged in part by the financial yardstick is hardly debatable.

Lumbermen, on the other hand, need to realize that proper care of the forest is not necessarily an unprofitable venture even from the purely dollars' and cents'

standpoint. To close one's eyes to the fact that silviculture affords a means of perpetuating and improving the forest at little or no net cost, or even at a profit, hardly shows the acumen with which business men are generally credited.

Selective logging has proved useful in demonstrating to both foresters and lumbermen that in certain forest types profitable utilization is not only compatible with but may actually be promoted by good silviculture. Broadly speaking, it has pointed out to each the importance of taking into consideration the other's point of view, and has challenged them to work together in making silviculture and economics real allies in the management of our forests.

There is, however, danger in the careless and indiscriminate use of the term. Selective logging may prove a curse instead of a blessing if it is invoked to justify the "creaming" or "high grading" of the most profitable areas, trees, and logs without regard to what effect this may have on the rest of the forest. To use the term merely as the equivalent of partial utilization, with no connotation of silvicultural measures, is to invite disaster. Forest deterioration will be no less undesirable because called by another name.

Danger also lies in the tendency which is apparently developing of using "selective logging" as the equivalent of "forestry." Desirable as the right kind of selective logging undoubtedly is, it would be most unfortunate for the impression to get abroad that the relatively simple and restricted measures which it contemplates include the whole of forestry. Protection of the forests from fire, insects, and disease, other aspect of silviculture, forest regulation, forest valuation, the management of wild life, wood technology, and forest influences are all important branches of forestry which lie outside the scope of selective logging, although interest in them may and should be promoted by it.

Selective logging will prove a lasting boon to forestry if, and only if, it continues to unite silviculture and utilization in a mutually advantageous alliance; and if it is clearly recognized not as a panacea, but merely as a first step toward more intensive forest management.

A PROPOSED REMEDY FOR OUR FORESTRY ILLNESS [1]

By ROBERT MARSHALL

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Requirements of a Satisfactory Forest Policy

ALTHOUGH it would seem patently ridiculous for a physician to attempt to diagnose an illness and to prescribe a treatment if he did not know what the characteristics of a healthy body were, it is quite the normal thing to diagnose social ills and prescribe treatment without having the remotest conception of what is required in a socially healthy situation. In presenting my remedies for our present forestry illness I will strive to offer a more logical approach to the problem by: first, considering the requirements of a satisfactory forest policy; second, examining the success of the existing forest situation in meeting these requirements; third, analyzing the causes of failure; and finally, choosing some solution or hybrid of solutions which appears most capable of fulfilling the needs of a sound national forest policy.

The scope of a satisfactory forest policy is twofold. It must protect the values of the forest as a natural resource, and it must provide the basis for the successful management of the forest as an industry.

As a natural resource the forest has four major importances. It furnishes the raw material for the lumber and other wood-using industries, which consume 22 billion cubic feet of wood annually in the United States (1) and rank among the eight major manufacturing industries in the country (2). It regulates the flow of streams, reducing the height of the flood stage and increasing the water flow during dry periods (3). It curtails soil erosion, which otherwise proceeds at a devastating rate in all mountainous sections (3, 4). It gratifies recreational and æsthetic yearnings which are, for many people, the most vital considerations of life.

From an industrial standpoint it is imperative that the management of the forest should guard the interests of four classes of people. These are the owners of the forest, the people who make their living working in the harvesting of the forest crop or in the manufacturing of forest products, the consumers of wood, and all those who are part of the community in which the forest industry functions.

What Uncontrolled Private Ownership is Doing

The policy at present in effect over all of the forest land of the United States, except 20 per cent which is publicly owned, is to let the private operator do just about as he wishes and trust to

[1] Grateful acknowledgment is made for the advice of the late Louis Marshall of New York on legal matters discussed in this article, and for the assistance of Joseph Gould and George Marshall of the Brookings School of Economic Research in economic considerations.—R. M.

altruism and enlightened self-interest for any forestry which may result. The only exceptions to this generalization have been a few mild state laws, and the persuasive power which the government has exerted moderately in granting coöperation in fire protection. Otherwise, the private operator may be said to have *carte blanche* in the management of 80 per cent of the American timber resources. Let us examine the success with which this system is meeting the requirements of a satisfactory forest policy.

First of all the fact stares us in the face that approximately 100 million acres of timberland have been devastated (1, 5), an area which embraces more than 20 per cent of all the potential forest land in the country. In the three Pacific Coast States, which contain half of our remaining timber supply, 40 per cent of the area cut to date has been left unproductive (6). A recent incomplete survey by the Society of American Foresters indicates that only 165 out of some 15,000 logging concerns are practising forestry, and that only 8½ million acres out of 220 million are under permanent industrial forest management (7).

Even if further study should double these figures, the total area under forestry practice would be a mere drop in the bucket. Voluntary private effort emphatically has not worked in keeping forest lands productive.

The record of private devastation answers the question of how well the present system of uncontrolled private initiative has protected streamflow and guarded against erosion. One hundred million acres of deforested land have certainly done more harm from the standpoint of erosion, and have probably evoked greater evil in the flood situation, than all the corrective effort of the government has been able to counteract.

From a recreational standpoint even the best silvicultural practice generally results in a tremendous diminution of the forest beauty. The crude exploitation of the typical logging operation just about removes the last trace of recreational value from most cut-over lands. To preserve the æsthetic worth of the forest requires either an exceedingly conservative cutting or no cutting at all, and such management the private owner is hardly ever able to provide.

From the standpoint of the operator and investor the lumber industry probably ranks in a dead heat with coal as the most unsuccessful of all major industries. Even the large companies find their reward much slighter than that in most businesses, while the number of small operators continually going bankrupt is appalling.

The worker in the lumber industry is very poorly situated. The present policy of logging a region and moving on precludes the possibility of the worker having a stable home life, and thus brings into existence the typical vagrant lumberjack. The irregularity of lumber production means irregular work and many undesired idle days annually. The turnover in both woods and mill are larger in the lumber industry than in any other major work (8). The wages are much below the average (9, 8). In hazard the lumberjack's occupation is second only to that of the electric light and power worker among all the important industries of the country (10).

Only the present-day consumer has relatively profited by the administration of the lumber industry in the United States. He has gotten his wood at so

low a price that he has been able to use vastly more of it than his fellowmen in any other major country in the world. Contrasted to the annual wood consumption of 228 cubic feet per capita in the United States, it is instructive to note that the average consumption over the whole world is only 32 cubic feet (11). But, unfortunately, this cheapness today has probably been bought at the cost of tomorrow. Overproduction, which has so deflated present prices, in all likelihood means a future timber shortage and a consequent acceleration of prices.

It is finally necessary to consider what effect the lumber industry has had on the communities in which it has functioned. Here its record may fairly be considered blackest of all. It presents one gruesome tale of cut out and pull out, leaving the urban and rural communities which have sprung up around it to fall into the ruin inevitable without its support. Abandoned towns and deserted farms have typified the unregulated pursuit of private profit in every forest region of the United States (1).

Summarizing, we can say, then, that voluntary private forestry has failed to meet any requirement of an adequate forestry policy, except supplying cheap wood to the present-day consumer.

Causes of Failure

Before seeking a remedy for this intolerable situation it is important to analyze the causes of the failure of our existing forest policy. These may be separated into two major divisions: the economic and the psychological.

First among the economic bases of forest devastation and industrial instability is the length of time which must elapse before any expenditure for forest perpetuation will bear fruit. Even disregarding compound interest, and few business men are willing to do that, it is very hard for the average investor to spend money which cannot bring returns for at least two generations. And yet, that is a condition which any expenditure for forest reproduction must entail. The protection of unmerchantable advanced growth may bring an income in one generation, but a problematical dividend at the end of 30 years is not a very attractive investment with oil stock paying 150 per cent annually on original cost.

A second economic drawback to the practice of forestry is the great risk involved. There can be no question that with 25 million acres of forest burned annually, insect attacks epidemic over large areas, blister rust, chestnut blight, and larch canker rampant, the life of an investor in future timber values is not a happy one. Any adequate forest policy must reduce these risks to a basis comparable to the hazards encountered in other industries.

Four years ago I attended a dance at the schoolhouse of a community with a population of about 60, yet the building could have cared lavishly for 200 children. I asked one of my partners how in the world this little town could possibly afford such a magnificent edifice and her nonchalant reply was: "Oh, we make Old Man Weyerhauser pay for it." But Old Man Weyerhauser just about that time tired of paying with annual taxes on his standing timber the cost of rural extravagance, and commenced to throw on the already overloaded market his magnificent Clearwater white pine. It is the repetition of this same situation in countless instances

which has been one of the most serious obstacles to forest conservation. Standing timber is taxed annually by state, county, and town, even though it is yielding no dividend, so that the operator in self-defense is forced to liquidate his holding as rapidly as possible.

This ruinous taxation, coupled with the fact that the lumber industry is organized on a competitive basis which the law will not permit to be modified, results in the fourth great economic drawback to the practice of forestry, the tremendous overproduction of lumber. The result is unnecessary use brought about by the expensive methods of supersalesmanship, inadequate profits, or actual deficits due to the low prices of the glutted market, and consequent lack of incentive to invest in future forest crops.

The great psychological cause for the failure of uncontrolled private exploitation of our timber resources is that present private profit and future public welfare are not compatible. Neither enlightened self-interest nor altruism can overcome this situation in more than sporadic instances. The former is overwhelmed by the massive economic obstacles just mentioned. Few operators will voluntarily gamble a certain present income for a nebulous future one in the face of years of waiting, immoderate risks, and exorbitant taxes. As for altruism, human nature has not, in any appreciable proportions, reached that lofty plain in which personal gain is voluntarily sacrificed for the greater general happiness.

A Proposed Remedy

Even the cursory outline presented indicates the immense complexity of the forest problem, and the impossibility of finding any single panacea which will resolve every difficulty. A satisfactory solution of so ponderous a problem cannot rest on the facile foundation of a simple formula. There are many potentially useful tools for bringing health into the present pathological forest situation. The minimum of common sense would dictate the value of using all which can help, rather than selecting a single instrument which is a trifle more attractive than any other. Consequently, the remedy which I suggest is not government regulation, or monopoly, or coöperation, or socialism, but a combination of them all.

There are six distinct phases to the plan which I believe will overcome the numerous obstacles to the practice of forestry:

1. Government regulation to prevent deforestation, somewhat along the general principles embodied in the Capper Bill and practiced throughout most foreign countries.

2. Private monopoly under government regulation to prevent cutthroat competition and overproduction.

3. Greatly increased government cooperation with private owners in the protection of their lands from fire, insects, and fungi.

4. Government investigation to determine equitable tax laws, and combined government and private pressure on state legislatures to enact these laws.

5. Government research to determine both the minimum silvicultural practices which will keep forest land in a continually productive condition, and those practices which will result in the maximum forest development.

6. Public ownership to preserve lands required for recreation and lands of such

dominant importance in watershed protection that no cutting can be permitted upon them.

For the carrying out of government regulation it is suggested that a new branch of the Forest Service be organized. On this branch would devolve the task of seeing that adequate forestry measures were being pursued on all the large logging operations in the country. The basis for determining satisfactory forestry practice has already been provided by the Research Branch of the Forest Service, which has published for the important timber producing regions minimum silvicultural requirements to keep forest land productive. The new branch of the service would examine every logging operation removing more than some predetermined volume. This would obviate the tremendous expense of inspecting the innumerable petty cuttings which would have no important bearing on the main problem. For all areas not coming up to the minimum silvicultural standards a fine would be imposed, severe enough to make consistent violation of the regulation prohibitive. If the fine were not paid within a given time the government would have the power to condemn a sufficient value of uncut forest to pay the penalty. Any forestry more advanced than the minimum requirements would be welcomed, but knowledge and economic conditions are not yet ripe for the enforcement of such practice.

The great drawback to government regulation in the past has always been doubt of the constitutionality of such a measure. The decision of John Marshall (13), "Should Congress pass laws for the accomplishment of objects not entrusted to the government, it would become the painful duty of this tribunal to say that such an act was not the law of the land," has rendered unconstitutional numerous laws for the regulation of private industry, because the constitution confers no such power upon the federal government. But it does provide the right for the government to protect its property (14). Under this provision the Supreme Court held that the government could prevent construction of a fence enclosing its own land, even though the fence was built entirely on private property (15). In upholding the Migratory Bird Act it went a step further, holding that "nothing in the Constitution compels the government to sit by while a food supply is cut off and the protectors of our forests and of our crops are destroyed" (16).

It would not be a bit more far-fetched to hold that the prevention of devastation on private timber lands in mountainous regions is essential to the regulation of the flow of federal and interstate streams, and to the protection of lands which lie adjacent to them. In the West, where federal and private lands are intermingled, proper management of private lands could be demanded by the government to protect its own domain from fire. Throughout the country the influence of the forest on climate would be a valid excuse for government regulation because of the vast amount of water which private trees return through transpiration to the national atmosphere.

There is a less likely possibility of control contained in the federal power to tax. By this means it has been proposed to tax timber cut according to a regulation at a nominal rate and that cut otherwise at an exorbitant one (17). Such a scheme would virtually force

every private operator to practice forestry. However, the decision of the Supreme Court in the second Child Labor case held: "An act of Congress which clearly is designed to penalize conduct, the regulation of which is reserved by the Constitution exclusively to the States, cannot be sustained under the federal taxing power by calling the penalty a tax" (18). This makes it doubtful if a tax on improperly cut lumber would be held valid. On the other hand the closeness of the decision in the first Child Labor case and the different viewpoint taken in regard to the regulation of oleomargarine (20), narcotics (21), and state bank notes (22) by the federal taxing power, makes possible a reversal of the Child Labor attitude.

This scheme of government regulation does not preclude the use of state legislation for the same ends. Neither does it discourage voluntary private forestry. On the contrary, it stimulates it by protecting the volitional forester from competition with lumber produced by the cheap method of devastation.

The second phase of this proposed national forest policy, a private monopoly to prevent cutthroat competition and overproduction, would require a modification of the Sherman Anti-trust Law. With lumber (23, 24), coal, oil, a dozen manufacturing industries, and the labor unions all clamoring for its alteration, the time seems ripe to topple this antiquated statute.

Any change in the Anti-trust Law would have to provide for some federal control of the immensely powerful monopolies which would result (25). Since these would be interstate organizations, their regulation would fall within the interstate provisions of the constitution. This would furnish a particularly bright possibility of regulating private forestry practice. The government could license the shipment of all products of the interstate monopoly cut in a satisfactory manner, and bar all products improperly harvested (26). It would also be necessary for the government to protect the consumer from paying unreasonable prices and the worker from receiving inadequate wages and unsatisfactory working conditions, just as is done today among railroads and public utilities.

Government coöperation with private owners in timber protection and the government taxation inquiry should follow the present provision of the Clarke-McNary Act. However, it is exigent that greater funds be made available by Congress for fire control.

The research program planned for in the McSweeney-McNary Bill should satisfy the needs for increased knowledge in determining minimum silvicultural requirements and best silvicultural practice.

The present policy of the government in socializing land primarily valuable for recreation and streamflow protection should continue. The former could be cared for by existing national park, national forest, and public domain land. The latter would require certain additional purchases, as provided for in the Clarke-McNary Act.

I do not claim that the plan presented will furnish any positive solution of the American timber problem. Due to the fallibility of human prognostication no scheme can possibly have more than a good chance of succeeding, for in social problems there are no certain deduc-

tions. This solution is not, therefore, a sure bet. It merely seems to me to be the most likely horse on which to place our money.

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A CONTRIBUTION TO THE SOLUTION OF THE NATIONAL FORESTRY PROBLEM

By FREDERICK S. BAKER

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The Situation

WHAT new can be said of the economic forestry situation? Without a new foundation of basic facts, how can a new and truer picture be drawn? We have plenty of expositions of the situation—the pessimistic viewpoint of Ahern, the assurances of lumbermen that all will come out aright, the threat of famine and the rather simple means of averting it presented by the Forest Service in its series of pamphlets issued in 1920-1922. ("Timber: Mine or Crop?" the most complete.)

Where does the truth lie? As to the material and economic situation and its logical consequences you can pay your money and take your choice according to your prejudices. The "situation" is not simply a real affair of trees and devastation, fire and planting, it is rather what you will it to be in your mind. And that brings up the truly important problem—important, because it must be solved first. Mental attitudes toward the material situation are the chief obstacles to its solution.

The campaign for a national policy of some ten years ago quietly evaporated and left a heritage of conflicting attitudes that accounts for the apathy of today. We have, broadly speaking, four different groups and four different mental viewpoints of the situation.

1. The great general public with little interest in the forest—all those who feel strongly neither one way nor another on forestry. They are vaguely aware that our forests are being destroyed and something ought to be done. Their influence is small and their attitude can mean little at first. They have got to ultimately foot the bills, however, and must be prepared for their inevitable rôle.

2. Nature and civic fanatics. Their hearts are in the right place but they want to rush, trample down opposition, and see only their immediate aims. They are valuable allies, but out of hand, with ignorant leadership they rush in where angels fear to tread. The loose statements and the great campaign of the early part of the decade gave them a real opportunity and they have made much of it. They have found their own leadership and are often embarrassing rather than helpful. They are a class that will always exist, but the present mental situation gives them a free field in which to develop. All they require is a balance wheel, but nothing to serve as such has appeared since the subsidence of the "movement" as it was constituted in about 1920.

3. The lumbermen. The most important group of all is here, for it is the lumberman who is to become the timber grower—the owner of the forestry operation. The forester's attitude toward him

when the campaign for a national policy opened will not be forgotten for a long time. Ten years ago the lumberman was frankly militant against forestry and the whole idea. He had to be as a matter of simple defense against a sudden attack by foresters. After the more radical legislation which he feared was defeated and the foresters adopted a plan of co-operation, the attitude changed somewhat—especially the "official" attitude. The advantages of continuous operations were admitted and the desirability of maintaining the forests of America in a productive state was agreed to, at least as a theory. Nevertheless there remains a subsurface distrust of foresters. They still fear the Greeks even though they come bearing gifts.

Or if they no longer fear foresters, they certainly do not welcome them as coöperators in a common problem—for how much sympathy have foresters shown with lumbermen's problems, what technical skill have they shown in trying to help them? Can they look to them for technical aid? During the height of the campaign a series of pamphlets was issued, covering the material situation. Several were short and popular but two in particular—the "Capper Report" ("Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership," Report on Senate Resolution 311) and "Timber: Mine or Crop" (U. S. D. A. Yearbook, 1922) present masses of data and serve as the statistical basis for the picture of the situation, the forecast of famine, and the means of averting it. They are the forester's technical contribution to the visualization of the national problem and its solution. What do they offer the lumber industry?

They paint a picture of future famine without any adequate analysis of the rôle of present virgin stands in the situation; they talk of growth, while the lumberman considers cut. They exult over the successful forestry in the Northeast with $12-$16 pine stumpage, but slide over the situation of fir at minus 50 cents. They speak hopefully of planting, but little of its costs and failures. They present involved and fragmentary statistics in whose mazes one becomes lost, facts contradict facts and the whole thing ends up with little more than some Pollyanna hopes. A picture has been drawn that the lumberman, from training and background, believes to be essentially untrue. It is not specific enough to be convincing, and even if it is true the directions laid down for the lumberman are so much pious wishes and so little businesslike assistance that the whole thing must be dismissed by the lumberman as useless, if not a piece of pure propaganda, the old cry of "wolf, wolf" when there is no wolf. The net result of the campaign for a solution of the forestry problem has been the lumberman's loss of confidence in foresters, both as men and as technicians.

4. The foresters. To the already mixed-up elements we must add the body of foresters, who have issued from the campaign of ten years ago without unity of thought or purpose, apathetic, and rather inclined to work each in his own niche, with a narrow local viewpoint.

That violent differences of opinion as to method of solving the national problem should have arisen is not at all strange. Radical and revolutionary propositions developed in a few months and were thrown at the heads of foresters. All that is to be expected in

hectic times. But afterward everything went so flat that it is legitimate to inquire if the whole upheaval was not artificial, whether at any time foresters had a burning conviction that some real program was a national necessity. If foresters ever had such convictions, why did the defeat of a few plans—Capper Bill, Snell Bill, etc.—so completely take the wind out of their sails?

Again I must revert to those pamphlets, the Bible of the movement. They failed to convince even those prejudiced in their favor. For example, probably more of the rising young technically trained foresters of the country were touched in the collection of facts for these publications than by any other phase of the movement, and they had to present data that they must have felt to be fundamentally wrong. They were largely the men on the national forests and made tabulations showing their virgin forests as "non-producing," their burns as "producing," and in the final reports saw all the emphasis on growth and growing areas, little or none upon the effect of our present mature stands on the future. They saw pleas for a larger program of national forest reforestation, and knew of its tremendous failures in the past. They were proud of their national forests but saw no analysis of the part they might play in the future; they were dismissed as being "inaccessible" and "inadequate."

The Capper Report opens almost with an apology for the inadequacy of data. The use of rough approximations, indications, and partial figures continues through the series and is honestly admitted. If truth is the goal, what should be more logical than further studies, better data, more accurate expositions. Eight years have passed and still we rehash these old figures. Perhaps they were only intended as propaganda, and served their purpose. Well—perhaps—a disquieting thought.

And then comes the question of leadership. To a body of foresters internally split by theories, rendered doubly insecure mentally by the unsatisfactory "Bibles" issued officially, the behavior of the leaders becomes of paramount importance. The profession looks instinctively to the Washington office of the Forest Service for its leadership. Do the men there honestly believe in the orthodox picture of the "situation"—the "famine," the "depletion," all the spectres of ten years ago? What is the character of the literature issuing from Washington? Lukewarm. Silent.

There is no getting around it. Foresters as a whole do *not* believe in the famine, the shortage—in a word, the picture drawn officially in the Forest Service publications. And the more they study the more they see that you can believe what you want to simply in the light of your prejudices. These Bibles are far too like the real one in that respect. Every denomination of forestry thought can find statistical basis for its beliefs in these books.

I am afraid that few people will agree with these strictures. To prove the point perhaps I should be more specific.

The forest industry comes into a region, grows, reaches a maximum, decreases. Its cycle is made up of a vast number of interrelated factors. As the development goes on transportation improves, utilization changes; some markets develop, others fade out; substitutes cut in; inferior species become useful. All

these and more govern the development and decadence of the industry in a given region—somewhat analogous to the growth of populations. The economic seers of forestry have tried to face the future simply and have stood pat upon their figures of the 1920-1922 upheaval on the ground that trying to discern trends of all these factors in the future and integrating them was all more clever than truly useful. So have students of population. In this field, however, Raymond Pearl demonstrated that the factors which influence the growth of population—birth and death rate, famine, war, and plenty—operate in one place much as in another, and from the curve of the increase of population of flies in a bottle or the rise and fall of the population of a European country we can draw the curve of our own far into the future.

The same sort of thing appears when the history of lumbering is studied. Curve the regional cuts of the northeastern forest, the central, the Lake States, the North Carolina pine, and the southern forest and then redraw the curves on the basis of the maximum cut as 100 per cent. (All the necessary data appear in U. S. D. A. Statistical Bulletin 21, "American Forests and Forest Products.")

The differences shown in Table 1 are far less than would be expected from the different types, regions, histories, and forms of utilization involved. On the other side of the maximum there are of course fewer data. The figures given in Table 2 are clearly insufficient to project our curves of declining cut very far into the future.

Fortunately there are certain states whose cut culminated early. Their rise shows a curve that fits the average for entire regions very well, and therefore their decline (shown in Table 3) should

TABLE 1

REGIONAL CUT BY DECADES BEFORE THE MAXIMUM CUT EXPRESSED IN PER CENT OF THE MAXIMUM

Region	Year of maximum	Years before maximum cut: 10	20	30	40
		Per cent of maximum cut			
Northeast	1902	87	84	84	..
Central	1905	85	66	54	..
Lake States	1899	91	68	..	..
North Carolina	1913	73	37	20	15
Southern	1916	81	49	21	9
Average [a]		81	55	37	26

[a] From curves.

TABLE 2

REGIONAL CUT BY DECADES AFTER THE MAXIMUM CUT EXPRESSED IN PER CENT OF THE MAXIMUM

Region	Years after maximum cut: 10	20
	Per cent of maximum cut	
Northeast	71	35
Central	60	40
Lake States	57	32
North Carolina	53	..
Southern	83	..

TABLE 3

CUT OF TIMBER FOR CERTAIN SELECTED STATES BY DECADES AFTER THE MAXIMUM CUT, IN PER CENT OF THE MAXIMUM

State	Years after maximum cut: 10	20	30	40
	Per cent of maximum cut			
Vermont	85	57	30	..
Pennsylvania	56	23	..	..
Michigan	70	36	21	..
Indiana	44	21	..	..
Missouri	75	32	..	..
Colorado	59	35	..	..
Utah	75	54	37	33
Average[a]	67	40	22	15

[a] From curves extended.

future can safely be made. The results are shown in Table 4.

The longest and most significant of these state curves indicate by their trend that they will reach a minimum at about 12½ per cent, that is, even without forestry a region will produce about one-eighth of its maximum indefinitely. For the United States this would be some 5 to 6 billion board feet. The national forests are presumably to be managed intensively. They "will produce about one-fifth of the timber required by the United States" ("Timber: Mine or Crop?" p. 173). We wish somebody would tell us what this is. We can get lots of answers—the most probable being some 10 billion board feet. If the rest of the country produces only 4 billion, this makes the probable minimum for the nation 14 billion feet.

TABLE 4

FORECASTED CUT OF TIMBER IN THE UNITED STATES

Region	1920[a]	1930	1935	1940	1950	1960
	Billion board feet					
Northeast	2.5	1.4	1.1	.9	.8	.8
Central	2.6	1.5	1.1	.9	.7	.7
Lake States	3.2	1.9	1.5	1.3	1.1	1.1
North Carolina	3.2	1.9	1.4	1.0	.7	.7
Southern	12.3	7.7	6.0	4.4	2.6	1.9
Pacific	12.3	16.6	18.2	15.0	9.5	5.6
Total	36.1	31.0	29.3	23.5	15.4	10.9

[a] Figures for 1920 are put in to show the essential correctness of the method. The actual cut for that year was roughly 33.8 billion board feet, and was below normal. The forecasted cut for 1935 is given as it marks the culmination of the cut of the Pacific Coast.

be similarly applicable. These states, chosen as widely as possible, are: Vermont, Pennsylvania, Michigan, Indiana, Missouri, Colorado, Utah.

The Pacific Coast region has to be treated somewhat differently, for its curve has not yet reached its culmination. Comparing it with the curves represented in a tabular form in Table 1, it appears that the 1925 cut was about 80 per cent of the probable maximum, which ought to fall at about 1935.

With this series of curves, whose average represents the rise and fall of the lumber industry, a forecast into the

But what is this compared to what we need? England uses 120 board feet per capita. In 1950 with a population of 150 million the United States might well be able to get on with 18 billion board feet, for nations like individuals use what they can afford, not what they might like to use. The foresters' attitude has always

rather overlooked this, taking the stand that the nation needed about what it uses now and would continue to " need " it, whether it cost little or much. Much has been made of our cities—the St. Louis area, etc., whose requirements were far beyond the national per capita average. But what shall be said of Rhode Island—essentially Providence—with a per capita consumption of 200 board feet, and New Jersey with 215? Is a low use of timber to be considered a sign of industrial stagnation and backwardness?

If timber costs as much as it does in Europe, with stumpage around $20, and if forestry becomes profitable with stumpage around $20, may not our per capita consumption fall to European standards? Then the future picture shows requirements of 18 billion board feet, with a domestic production of 14 billion or so. Could we not import 4 billion feet? Could not forestry on our most favorable lands produce 4 billion feet? (Crude forestry on the Pacific Coast or in the South alone could produce that much according to " Timber: Mine or Crop? ") Then where is all this need of forestry, more and more, everywhere? Isn't it merely propaganda? Surely the orthodox picture is not binding if you choose to accept another.

Nor does this analysis exhaust the data. By taking other viewpoints still other results can be secured, dark or bright, anything you will. Space forbids further demonstration. Surely, nobody can take this as the infallible Scripture nor can he lightly dismiss the man who thinks the whole thing a mass of tommyrot. To tell the truth it is a poor structure, and as it is the authoritative exposition of the foresters' position it must be saddled with the blame for much of the muddled thinking, the distrust, the apathy that we inherit from the great campaign.

The Remedy

I have endeavored to show that ahead of the material problem we have a problem of perplexity, mistrust, doubt, opposition—a whirlpool of unfavorable mental conditions to be overcome. The author of this prize contest is obviously of the orthodox school, for he calls for a remedy which (a) will solve the problem of a permanent and sufficient supply of forest products; (b) will be applicable in actual practice; and (c) can be applied in time to meet the nation's needs.

I must confess that under the circumstances I cannot satisfy him, for I cannot prove what a " sufficient " supply of forest products will be. I am no seer, and I do not know anything about the nation's " needs," still less when they will come; for, as I have tried to show, I can make decisions on such points only on the basis of my own prejudices, as he does upon his and the lumberman does on his. The Bibles of forestry do not even come close to effectively dispelling these prejudices. Therefore my program must be very different.

1. Regain the confidence and solidarity and enthusiasm of foresters in a national program.

a. Through a consistent program of publications dealing with technical phases of the problem.

The publications already cited dating mostly from 1919-1922 are the source book, but, as I have tried to show, when dissected by technical foresters, their shortcomings in such a rôle are painfully evident. Every section in " Timber:

Mine or Crop?" could profitably be made the subject of a technical monograph, scientifically true, not an *ex parte* bunch of arguments such as that publication essentially is. Arms for the front-rank fighters are needed. Nobody can expect enthusiasm from a forester armed with an argumentative gun so built that it may backfire and slay its user.

b. Promote solidarity by putting off debatable points as to method until an overwhelming sentiment for maintaining the forests of America is developed.

To my mind, this never was really developed, in spite of all that was said and done, because the reason for demanding forest preservation on a national scale was built entirely upon a hypothetical economic situation dated about 1950. *Proof* of what the future will bring forth is impossible. The arguments and figures presented were inadequate to be even reasonably convincing. We have already shown that they can be made to present a very different picture of 1950 than the usual one. An edifice was built on rather insecure theories of economics and the whole result was shaky. Why not forget it? Let us have forests preserved because we in America want them preserved. Flatly that. Why shine your shoes, why pay $3.00 for a necktie, why paint your house with white lead when "barn red" is cheaper and just as good a preservative? Why mow your lawn, why water the grass? Simply because you choose to; you cannot prove your position by economics and finance. Why should not the country keep its national lawn green, from east to west, simply because it chooses to. A burned waste looks just the same to me in $10 white pine stumpage as in minus $.50 white fir, and nationally we should care in one case as much as another. This is not far from Wohlenberg's position as presented in the April, 1929, JOURNAL OF FORESTRY, with his stress on "indirect benefits."

We should certainly work for a better understanding of the economics of a national policy, but not let the policy stand or fall by economic proof. This idea will take a lot of time to soak in, but will lead inevitably to the next point.

2. Educate the public to the viewpoint that they must pay for forestry. This was virtually denied ten years ago. We were going to have *lots* of *cheap* lumber forever. The idea served more than any one thing to split foresters apart and gain the antagonism of the lumberman; they knew that *somebody* had to pay and it looked like them.

We complacently pay—and sometimes outrageously—to maintain our national industries in the face of foreign competition through the tariff. We have in timber farming an infant industry. We cannot foster it by the customary means of tariff until we use up all our timber and have to import—a most silly procedure. But here is the enemy to timber farming right within our boundaries, "devastation." Shouldn't we cheerfully pay more for our home-grown product than for that coming from the Land of Devastation, foreign to our national ideals? There is nothing new here. The Snell Bill amounted to just this. But it is too revolutionary to burst upon an uneducated public, an amazed body of foresters, a lumber industry that feared it, and legislators who are innately conservative. Of course to keep private enterprise going everywhere would require a very high "tariff," for production charges are high in many parts of the

west, costs of production are large, and markets are far away. Probably the people had better own such lands outright—more national forests. Our acquisition program is a mysterious, back-of-the-scenes sort of thing. Why not let foresters and the public know some of its possibilities; it might arouse some enthusiasm.

3. Cultivate the lumber industry. Study the lumbermen's problems, present monographs on successful forestry enterprises, analyze costs, and above all strive to prove the dollars and cents' worth of conservative cutting and the permanent business to the individual lumberman.

4. Educate foresters to the viewpoint that they are trained to make more profits for their employers through better forestry. To this end they should:

a. Understand accounting and business economics, in order to truly evaluate the financial feasibility of different alternatives.

b. Understand utilization as well as timber production.

c. See the land instead of the mill as the source of profit to the enterprise, and know the value of by-products of the land as well as of the tree.

d. Learn how—as part of their technical training—to conduct time studies and efficiency surveys.

All this simmers down to two main jobs; the lesser ones will fall into line of themselves.

1. The Forest Service must assume leadership and act as though it had a sincere desire for a national policy.

a. It must continue indefinitely a series of publications dealing with the subject and not appear to consider its decade-old expositions the last and most convincing word on the subject. There must be both popular education and technical information.

b. It must assume a more dispassionate and carefully balanced attitude, gain the confidence of the lumber industry and indeed of foresters in general, even its own personnel, and afford ballast to the overly enthusiastic elements.

c. It must show a real sympathy and technical helpfulness in the problems of the lumber industry.

2. Forest schools must train men not so completely for public service and more for profitable forest operation.

This is no plan for the solution of the material problems; it merely presents a plan to align interests, promote unity, revive a lost morale, and thus develop a mental situation in which a workable plan can be evolved. Any thorough plan, no matter how good, striking directly at our material evils, is bound to become so involved in the psychological web that it hasn't a chance of success. Either we must choose the weak alleviation of "Clarke-McNary" money or clear away this unfortunate mental chaos in order to build a real plan that will work.

A NATIONAL FOREST POLICY

By GEORGE H. CECIL

Executive Secretary, Los Angeles County Conservation Association

IN PAINTING a picture of forest conditions as they exist in the United States today, one is confronted by the lack of accurate statistics. However, "Deforested America," the most recent publication intended to cover conditions in the country as a whole, based as it is upon the best obtainable statistical information and qualified by the individual opinions of well-informed foresters, may well be considered an accurate analysis of existing conditions.

Summarizing, with the above publication and its referenced data as a basis, the situation is as follows:

The original area of timber in the United States was 822 million acres, with an estimated total stand of 5,200 billion board feet. Up until 1927, 722 million acres, or 88 per cent of the area, had been cut over. Approximately 200 million acres had been cleared for agriculture, and 153 million acres more were in farm woodlots; 270 million acres of the cut-over area were producing a total of 10 billion board feet per annum. The remaining 100 million acres had been denuded.

The 722 million acres estimated to have been cut over up to 1927 yielded 4,000 billion board feet, or approximately 5,500 board feet per acre. The remaining 100 million acres have a much heavier stand, approximating 1,200 billion board feet. Thus, while there is left but 12 per cent of the original forest area, there remains 23 per cent of the virgin stand by volume.

The annual cut of timber in the United States amounted to 53 billion board feet in 1919. To this amount must be added 7 billion board feet annually, due to loss from fire, insects, and other preventable causes. This loss is in addition to an annual preventable waste due to low standards of utilization in the woods and mill, of approximately an equal amount, included in the above mentioned 53 billion feet. The total loss and consumption is, therefore, 60 billion board feet (approximately 25 million cubic feet), of which 14 billion board feet represent preventable waste.

The annual per capita consumption of timber is approximately 212 cubic feet, of which 110 cubic feet (502 board feet) is sawtimber.

The annual lumber cut totaled 38 billion board feet in 1925. Seventy-five per cent, or 28 billion board feet, came from virgin stands.

In order to visualize conditions as they will exist fifty years hence, it becomes necessary to estimate the probable total consumption from 1928 to 1980. It is estimated that the population of the United States will increase from a probable 120 million in 1930 to 175 million in 1980, the rate of increase dropping gradually both in total and percentage.

Starting with 25 million cubic feet estimated as consumed and wasted in 1919, it is assumed that this figure repre-

sents consumption as of 1928, thus securing a basis for figuring depletion based on the estimate of the remaining stand as given by Major Ahern.

Reducing, for the sake of conservatism, the annual per capita consumption from 212 cubic feet to an average of 180 cubic feet, representing approximately a 50 per cent decrease by the year 1980, upward of 1,500 billion cubic feet of timber will have been used by 1980. Suppose, however, that 2 billion cubic feet of the amount now annually destroyed are saved, plus an additional 2 billion cubic feet conserved by improved utilization, or a total of 4 billion cubic feet annually. Deducting this amount from the total, approximately 1,300 billion cubic feet will have been used. If but half of this amount is assumed to be sawtimber, the virgin supply will have been used two and a half times over and an additional 650 million cubic feet of miscellaneous material will be needed. The second-growth stands, estimated as now producing 10 billion board feet annually, even with a five-fold increase, would furnish less than half of the amount needed to make good the deficit in saw material alone.

Immediate action to speed up timber growing is imperative. If time were no object, the problem might be left to work itself out. But in this case time is all important. Steps must be taken at once to see (1) that the remaining stand is so cut as to insure at least against denudation; (2) that the volunteer second growth is adequately protected from fire; (3) that the quantity and quality of such second growth stands are improved; and (4) that the denuded areas are restocked.

In the consideration of remedial action, a choice must first be made between coercion, subsidy, and coöperation, and a further choice made as to whether necessary regulation should be federal or state. It seems highly improbable that regulatory federal legislation can be framed which will be effective and at the same time pass the test of constitutionality.

Regulation, to insure the desired results, must be both uniform and flexible: uniform enough to leave undisturbed existing competitive conditions, flexible enough to meet conditions as they exist in the woods.

The Clarke-McNary Act has blazed the way in coöperative endeavor. If the problem is approached from the same angle, the advantage of an established precedent is gained, one which has received the endorsement of all concerned and resulted in at least a partial attainment of the desired objective.

Following the principles laid down in the Clarke-McNary Act, federal legislation is proposed which will authorize the Secretary of Agriculture to determine (in coöperation with appropriate officials of the several states) for each forest region such systems of forestry as will adequately provide for the perpetuation of forests of the states, growing upon such state or private land as shall be jointly determined to be more valuable for the production of timber than for other uses or crops.

As rapidly as states enact laws that will put into practice such systems of forestry as shall be thus jointly determined, the federal government will authorize the Secretary of Agriculture to coöperate with such states under conditions provided later and will make available sufficient funds, based upon the

estimates of the Secretary of Agriculture, to make such coöperation possible.

Uniformity will be assured through the broad information at the command of the Secretary of Agriculture, flexibility through state administration of the regulations in the woods. Once the necessary measures are determined and made effective by state legislation, practically the entire local application and responsibility will be placed upon the state boards of forestry. Such a procedure will tend to build up a real state forest service within the several states and eliminate the bugaboo of federal supervision.

Federal legislation is suggested extending the coöperative principles of the Clarke-McNary Law as follows:

1. Increase of federal participation in adequate fire protection up to 25 per cent of the total.

The partial failure of fire protection under the Clarke-McNary Act has been due to the lack of funds. The private owner has done his part in as far as the protection of mature timber and more advanced second growth is concerned. With a higher actual cost of the protection of restocking stands, the incentive of added federal participation is urgently needed. Further, such participation on the part of the federal government will act as an incentive to the states which, in many cases, have failed (as has the federal government itself) to assume a full 25 per cent of the burden.

2. Reimbursement to the state, or other political body, for expenditures up to 50 per cent of the total cost of adequate protection of

a. Lands not adapted to the growing of timber commercially, but whose protection is essential to the protection of adjacent timberlands.

b. Purely protection forests.

c. Brush and similar lands important for watershed protection and flood control.

While these provisions go further in aid to the states than any previous proposal, there is no new principle involved. The original conception of federal obligation as expressed in the Weeks Law confined participation to the protection of the watersheds of navigable streams. Subsequently, the Clarke-McNary Act extended such protection to watersheds in general, while a later amendment left no doubt as to its intended applicability to purely protection watersheds. The suggested action is, therefore, the logical development of a principle already laid down by Congress.

3. Underwriting of mutual insurance (fire, fungi, and insect) on mature and immature timber.

Timber insurance has not proven a productive field for private capital. The rates quoted have not been attractive to timber owners and little such insurance has been written. The government, in close touch with the situation, particularly the adequacy of the protection from fire, is better prepared to rate the risk than is the average insurance company. Given the support of the government, it is believed that a large acreage will become interested and will make possible mutual timber insurance at a rate that will be attractive. A part, at least, of the incentive toward rapid liquidation should thus be removed.

Insurance in the case of reforesting lands would remove one more obstacle to the practice of industrial forestry. Such insurance should, however, be confined to the actual cash investment and should include no land value.

4. Permit "industry" under regulation of Secretaries of Agriculture, Commerce, and Labor, to effect such combinations, not detrimental to public interest, as may be deemed necessary to stabilize the industry by adjusting production to consumption. Regulations to be administered by Federal Trade Commission.

Violent price fluctuations have for years been characteristic of the lumber industry. Such unsettled conditions have been a factor in retarding timber growing. Any occasional benefit the public may have received in reduced lumber prices will be much more than offset by the higher prices that will attend a timber shortage. There is, therefore, need for federal action tending to stabilization of the industry.

5. Authorization to the Secretary of Agriculture to enter into agreements with the owners of any timber within, or partly within, or adjacent to, any national forest for the joint management of such private and government timber where, in the opinion of the Secretary of Agriculture, such action will best secure the proper management of such lands and will not be contrary to public interest. Such timber to be sold to the owner of said adjacent private timber at such times and in such amounts as the Secretary of Agriculture deems expedient, at not less than the average price received by the government for similarly located timber during the previous three-year period.

In the national forest states, particularly those of the Pacific Coast, a condition exists where private and federal lands are either intermingled or adjacent. Since an object in forest management in general is to place forest areas on the basis of a sustained yield, such lands should be managed as a unit where necessary in the attainment of this objective, regardless of the ownership of the lands involved. Present legislation requiring the sale of government timber to the highest responsible bidder makes such plans at least uncertain.

6. Payment by the federal government to the state of five cents per acre per year for a period of 30 years on cut-over lands on which growing timber has been exempted from taxation.

Taxation which has failed to recognize growing timber as a crop has been blamed and is undoubtedly a considerable factor in the present situation. The uncertainty of future taxation especially militates against the holding of cut-over lands for a second crop. Federal participation in the carrying of such lands for thirty years will add a material incentive to the state legislation exempting cut-over lands during the period of regeneration. Details of such legislation, as to whether or not a yield tax is desirable, etc., may well be left to the states themselves.

7. Reverting timber lands.

a. Payment by the federal government of 50 per cent of the cost of rehabilitating lands which have reverted, or may revert, to states or counties for taxes. Based on a twenty-year plan.

b. Payment of 50 per cent of the cost of adequately protecting such lands from fire for a period of thirty years following habilitation.

c. Payment of five cents per acre per year for a period of thirty years, to go to the political subdivision concerned, in lieu of taxes.

It is extremely doubtful whether the individual states can or will bear the cost of the rehabilitation of denuded lands

unaided. These lands, in their present condition, are an economic loss not only to the state but to the nation. The public is justified in sharing liberally in the cost of restoring their productive capacity.

State legislation will be necessary to clarify existing laws dealing with the redemption of lands reverting for non-payment of taxes, provision being made either to fix absolutely the title in the state, or else to provide for the payment of all expenses with interest, in case of repossession by the original owner.

8. Payment of 50 per cent of the cost, up to $5 per 1,000 f. o. b. nursery, of planting stock to be furnished at cost to any agency desiring to use such stock for commercial planting under state supervision.

This provision amending existing legislation extends the privilege of acquiring planting stock at cost to any person or firm desiring it.

Correlated state action may be classified under two headings—obligatory and optional. Items classified as obligatory deal with regulations of the industry considered as essential to prevent denudation and give assurance, from a purely physical standpoint, of the growing of a second crop. The public has the right to demand such action as a consideration precedent to the concessions granted and assistance guaranteed under federal provisions 1 to 5.

Obligatory action:

1. Putting into effect regulations made jointly with the Secretary of Agriculture for the cutting of timber.

2. Creating and financing a state board of forestry to adequately administer cutting and other regulations.

3. Increasing state participation for adequate protection of timber lands, up to 25 per cent of the total.

4. Providing adequate protection from fire of all privately owned timber growing on land classified as principally valuable for that purpose.

5. Paying, either itself or through its political subdivisions or otherwise, 50 per cent of the cost of the adequate protection of

(a) Forests not adapted to the production of merchantable timber but constituting a menace to other lands.

(b) Purely protection forests.

(c) Brush and adjacent lands important for watershed protection and flood control.

Optional action:

6. Exempting the growing crop from taxation for a period of at least 30 years.

7. Preparing and financing up to 50 per cent of the cost a program providing for the rehabilitation within 30 years of all cut-over and burned-over timber land reverted, or reverting, for taxes.

8. Clarifying existing tax title laws, placing title to reverting forest lands in the state.

9. Providing adequate protection for rehabilitating lands and paying up to 50 per cent, either itself or through its political subdivisions or otherwise, of the cost of such protection.

10. Providing for state nurseries for the growing of needed trees.

11. Furnishing at cost, f. o. b. nursery, planting stock to any agency desiring stock, and supervising such planting.

The various provisions of legislation here proposed place upon the federal government a considerable burden. It is felt, however, that such a burden is fully justified. The present situation,

wherein the bulk of the originally vast timber resources have passed into private ownership, is the result of the federal policy of land disposal as expressed in past and present public land laws and the abuse of such laws. The present owners of such lands certainly cannot be penalized. The responsibility is that of the federal government, and the people as a whole should bear the major—or at least a large share—of the cost of remedying the existing conditions.

Further, if such expenditures will prevent a national timber shortage, the cost will be much less to the nation as a whole—both on the score of wood supplies and serious social and economic losses—than would result if existing disastrous conditions were allowed to go unchecked.

THE APPROACHING TIMBER SHORTAGE—CAN IT BE AVOIDED?

By ELERS KOCH

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THE history of the progress of the axe and saw across the American continent has been so many times told that it is unnecessary to repeat it. The most essential part of the picture to keep in mind is the successive rise and decline in lumber production of region after region. Lake States, Central States, Northeastern States, North Carolina Pine States have all gone through this stage. The Southern States have started the period of decline, and the Pacific Coast States alone are still in the ascendant.

The Census figures of lumber production by regions are a most vivid picture of American forest history. As an indication of what happens to production in a region after the bulk of the virgin timber is gone, the figures given in Table 1 for four regions are illuminating.

These figures seem to indicate that 20 to 30 years after passing the maximum figure of production these regions still maintain a cut of one half to one quarter of the maximum. This cut is made up partly from second growth, partly from remaining virgin stands, and partly from a second or third cutting in culled stands. The curve of production for all four of these regions still shows a slight decline, and probably none of them has yet fully reached bottom.

The next step in the progress of depletion is taking place in the Southern States. Here the peak of production is clearly past and the curve will fall rapidly through the next ten years. It is not probable that the ratio between the peak and the low point will fall as low as in the Lake States. Good authorities estimate that production will be maintained from second growth at somewhere around 5 billion board feet a year, which may be over-optimistic.

This brings us, then, to the final stage, the transferring of the cut to the three Pacific Coast States. The Rocky Mountain States may be passed over with the assumption that with the high percentage of national forest land the cut will be sustained at somewhere near the

TABLE 1

MAXIMUM AND PRESENT LUMBER CUT FOR FOUR REGIONS

Region	Maximum cut		1926 cut	Ratio between present and maximum cut
	Million bd. ft.	Year	Million bd. ft.	
Northeastern States	5,709	1899	1,409	1 : 4.1
Central States	5,643	1899	1,987	1 : 2.8
North Carolina Pine States	5,177	1909	2,568	1 : 2.0
Lake States	8,750	1899	2,047	1 : 4.3

present 1¾ to 2 billion feet. If we assume that the South will drop in the next ten years to a cut of 5 billion, and the four depleted regions shown in Table 1 maintain nearly their present cut, then, in order to hold up the present requirements of the United States, the cut would be something like this.

	Million bd. ft.
Southern States	5,000
Northeastern States	1,250
Central States	1,500
North Carolina Pine States	2,000
Lake States	2,000
Rocky Mountain States	1,750
West Coast States	24,500
Total	38,000

It is quite possible that the Eastern and Southern States will drop in production even lower than these figures show. In that case the cut in the West Coast States will be proportionately greater.

The best estimate now available for the Pacific Coast States is the 1927 compilation by the Western Forestry and Conservation Association. This estimate shows federal timber 369 billion, state 24 billion, private 569 billion board feet.

The 1927 cut of national forest timber in this region was 646 million feet. The sustained yield of the national forests is about 4½ billion feet. This will probably not be reached for many years, since much of the national forest timber is inaccessible or of low grade.

If we assume that in the next 10 years the cut of the West Coast States will rise from the current 14 billion to between 20 and 25 billion feet, the average drain on the private and state timber through a 25-year period might be about 20 billion feet a year. Past experience has shown that the cut of any region commences to drop off long before the last tree is cut. The Lake States, for instance, have cut 125 billion feet since the 1899 peak of production.

Within 25 years the remaining private and state timber in the Coast States will be more than four fifths gone, and production will begin to decline. When the Coast States production declines, so does the national production, and this period, however imperfectly calculated, marks the beginning of the national timber shortage at about 1955. In this rough calculation other material than sawtimber has not been considered.

The next question is, how far second growth on cut-over lands can be expected to replace the virgin forests. It should be kept in mind that the bulk of the timber cut in the United States has been taken off since the Civil War, beginning on a large scale about 1870. That is 60 years ago, and if the virgin timber lasts another 25 years the first cut will have been completed mostly in a period of 85 years, or one short sawtimber rotation for most regions. If every acre cut during that period had been adequately reproduced to a stand equal to the original stand, we would have no more than maintained a sustained yield. Since everyone knows there is no such succession of second-growth stands coming on to take the place of the virgin stands, it is obvious that in just so far as that succession falls short, the nation's future cut must be curtailed. On the basis of all data available it is not likely that the United States has one third of that required growing stock.

Sawtimber cannot be produced to order in a period of 25 or 30 years, and it may therefore be stated confidently that

there is no possible action which can now be taken which will maintain the United States lumber production at its present level through the period from about 1955 to 1990. The best that can be done is to ameliorate a bad condition.

Where must the supply of sawtimber through the period of shortage be derived from? Obviously the bulk of it must come from already existing second growth on cut-over or burned land which is now old enough to reach sawtimber size through that period. Disregarding limited areas of especially rapid growth this would mean stands now 30 years or more of age. A second source would be from a second cutting with accrued increment through proper selection cutting in the remaining virgin stands. This would be limited only to such types as lend themselves to that form of cutting, as the western yellow pine, New England spruce, and some of the hardwoods. It would not apply to the Coast Douglas fir and redwood stands, which will form more than half of the next 25 years' cut. Consequently, the protection and bringing to maturity of the second-growth stands of the country is of even greater consequence than the proper treatment of the remaining virgin stands.

We now come to the question of what measures can or should be undertaken in order to save what can be saved out of the wreckage of the forests. There are three primary objectives: First, to save second growth already established or to be established from fire and premature cutting; second, to ensure that future timber cutting is done in such a way as to continue the productivity of the site; third, to restore timber growth on devastated or degraded forest areas. The first objective is the most necessary and urgent in its effect on the impending timber shortage.

There are three lines of approach toward accomplishing the foregoing objectives: (1) Legislation by federal government or states compelling good forestry practice on privately-owned timberlands, as illustrated by the Capper Bill. (2) Encouragement of forestry by private owners through propaganda, research, and favorable legislation and aid through state or federal appropriations. (3) Acquisition and management of a large percentage of forest lands by federal and state governments.

The first plan has many objections. It is bitterly opposed by most timber owners and has been supported by only a minority of foresters in the United States. The mere difficulty of enforcement of a compulsory forestry law should make its advocates hesitate. Recent years have shown us the difficulty of enforcing a law of the "Thou shalt not" type which is unpopular in the view of a considerable fraction of the people. How much greater would be the obstacles to enforcement if a law requiring positive and constructive action by individuals against the will of many of those concerned. Forestry is a complex and technical job. There are enough difficulties in the way of a willing operator, but to imagine that thousands of unwilling owners of millions of acres could be forced into good forestry practice is more than can be reasonably expected.

The next proposal to be considered is the voluntary management of the bulk of the country's forest lands by private owners, assisted and encouraged by favorable tax legislation, and advice and financial assistance or subsidy by federal government or states. This is practically

the basis on which we are now standing, as exemplified by the Clarke-McNary and McSweeney-McNary laws. Will progress along those lines be an adequate and sufficient program to meet the country's timber requirements in view of the emergency existing? It will be adequate only in case the preponderance of these owners decide very soon in good faith that they will manage their lands for the production of timber, or can sell to someone else who will do so. Forest land owners are more or less a cross-section of the American people. They range all the way from large corporations with 20 or 30 years' cut, through the smaller mill men down to the individual holding only a 160-acre timber claim, besides the many small tracts in farm woodlots. As an example, the Forest Service reported in 1920 that there were 17,000 owners in Oregon holding tracts of less than 25,000 acres of forest land. In Northern Idaho 39 owners of more than 1,000 acres control 1,550,000 acres, while 2,120,000 acres are held in tracts of less than 1,000 acres. Most forest land owners acquired their land for purposes other than the objective of engaging in the business of timber growing.

Any investment expert will assert that investments should be adapted in type to meet the particular needs of the investor. One individual may find it desirable to put all his capital in the most conservative type of bonds. Another is so situated that his capital will serve him best in a mercantile business or a manufacturing concern. Surely the timber-growing business is not a magic industry which fits all types of investor. As a matter of fact, it is an investment which is very restricted in its field. With often long-deferred returns, frequently involving an additional annual outlay of funds, and generally with a considerable non-insurable risk, it is obvious that however profitable a timber-growing investment might be, there are large classes of capitalists, including many present timberland owners, to whom such an investment is absolutely unsuitable. This is in no sense a disparagement of the possibilities of industrial forestry. It is merely a common-sense statement of its restrictions in the investment field which all professional forestors and economists must recognize.

What is going to be done, then, about the vast holdings of timberland now in the hands of corporate or individual owners who do not feel that their investment requirements will be met by the timber-growing business? Presumably in the course of time transfers of ownership would eventually result in much of this land finding its way to the hands of corporations or individuals who are in a position to hold it for timber production purposes.

Such an adjustment will necessarily take a long time, and much of the lower value land would never find a place in private ownership. In the meantime, much land is reverting to the counties for taxes, second-growth stands, which are the only hope for production during the period of greatest shortage, are burning up or being prematurely cut during their period of maximum growth.

Major George P. Ahern has vigorously and, in general, correctly stated the situation in his "Deforested America." Action which should have been taken 30 years ago has not yet been taken. The public has never fully realized the national timber situation in its entirety, and foresters have been of late years lulled into a sense of false security. Progress,

and small progress at that, considering the size of the job, has been taken for accomplishment. Every year that the present unsatisfactory condition continues makes the ultimate situation that much worse. Conditions demand immediate action for the welfare of the nation. Should not the public, then, take direct action rather than await the slow development of private initiative in the job of growing timber?

In the judgment of the writer, the one most important action to be taken in the nation's forest program is a very large-scale plan of acquisition by purchase, of forest lands in all forest regions, by both the federal government and the states. Just how much acreage should be acquired is a matter to be developed as the program progresses. As Napoleon Bonaparte once said, " He will not go far who knows from the first whither he is going."

The acquisition program should develop as conditions indicate, but as a tentative goal, Major Ahern's suggestion of 100 million acres for federal acquisition is none too high. The area of private timberlands is given by the Forest Service in 1920 as 369 million acres. Excluding 143 million acres of woodland on farms, which would not generally be suitable for government ownership, leaves 226 million acres. If the federal government acquired 100 million acres and the states, say, 25 million, that would still leave 100 million acres for the field of industrial forestry.

Too much has been made of the present acreage of national forests. The total of 139 million acres in the United States sounds impressive, but, considering the vast areas of grassland, brush, burn, steep rocky country, subalpine forest, low grade lodgepole pine pole stands, and overmature defective forests of poor species, it is doubtful if the total area is equivalent in productive capacity to 40 million acres of the average privately owned timberland.

The case for large public ownership of forest land is a strong one. It is a direct public solution of a public problem. It is the only solution which can be quickly enough applied to be effective. Even the strong individualist who looks with disfavor on the encroachment of government agencies into the industrial field must see that forest ownership and management is a field particularly adapted to the state. Most of the land which would be involved is cut over or burned. This means holding for a long period protecting and reforesting, with small returns and considerable expense for a long period. The indirect returns, which are mainly a public concern, are often greater than the direct returns. It has been argued that since there are many possible substitutes for wood for most uses, there is no occasion for getting into a stew over the matter. We can simply drop down to a lower per capita wood consumption and be satisfied to keep only a portion of our forest producing. It is hardly conceivable that this solution would be permanently satisfactory to the people of this nation. The mere thought of abandoning large areas of our territory as unlovely and unproductive stumpland burned by uncontrolled fires, a useless festering sore in the landscape, is to me unthinkable. Considering the vast amount expended by the public each year for parks, ornamental and memorial structures, and similar purely æsthetic or sentimental purposes, the few million a year to keep

green forest on natural forest land seems inevitable.

The cost of 100 million acres would probably not average over $4.00 per acre. Spread over a period of 10 years this would require an annual appropriation of 40 million dollars. Administration and protection of the entire area would cost 10 million dollars annually. These are big figures, but not too big for a nation with the resources of the United States, considering what is involved.

Forest land acquisition by the states is fully as desirable as federal acquisition, but considered as a matter of probable accomplishment, federal action seems more promising than state. State-owned forest lands now total about 11 million acres. An additional 25 million acres by the states might be set up as a desirable goal. Some states, such as Montana and Idaho, are perhaps carrying as much forest land as can be expected, considering their limited population and wealth. The leading forest states are in general poor states, relatively speaking, and too much cannot be expected of them in the way of forest-land acquisition.

Objection will be made in some states to large-scale federal acquisition. It is not believed that this will be a serious obstacle, particularly in those regions which can see a fast-diminishing industry and no adequate solution to the cut-over land problems. Such communities will generally welcome federal intervention, bringing cash for their apparently useless lands and assured protection and development.

Federal and state ownership seems to be the only adequate and quickly applied plan for handling the forest-fire situation. The present annual burning over of 20 to 30 million acres is such an unthinkable condition that it is useless to talk of forestry as an accomplished fact until something adequate can be done about it. The main reason for such a condition is the fact that the present owners of forest land, aside from merchantable timber, are not sufficiently involved in the business of growing timber to pay for protection. Some owners are prepared to meet the cost, but until an outlet is found for the land belonging to owners who are not in the timber-growing business, fire conditions will remain unsatisfactory.

While federal and state acquisition and management of forest lands should be the backbone of a constructive plan for the forests of the nation, this should by no means exclude the advancement of industrial forestry. American methods of thought turn slowly toward very long term operations. We have been accustomed to a quick turnover and to rapid changes in conditions. Any other viewpoint is bound to come slowly and gradually.

Conditions are becoming more favorable for private forestry. Reform in methods of taxation of forest lands is making good progress. The recent Idaho and Oregon bills went through the legislatures with surprising ease. So far as federal legislation goes, if the contemplated appropriations are made by Congress under the Clarke-McNary and McSweeney-McNary Acts, federal cooperative action is pretty well taken care of. Many of the states still need to do much in the way of setting up machinery and making appropriations to improve the forest-fire situation.

We have gone through a stage in the last few years when it has been con-

sidered treason for any forester to question the adequacy of a coöperative solution of the forest problem mainly through the medium of industrial forestry. Any suggestion to the contrary has been construed as undesirable disparagement of the possibilities of private forestry. Happily, it is believed we are passing out of that stage and foresters are getting away from the absurd idea that every owner of forest land could and should go into the timber-growing business. Land owners will always be ready to do their share when they can see adequate profits in the business, and it is the job of foresters to show them when and where that possibility of profit exists.

The impending timber shortage is so certain, and the urgency for immediate action is so great that the nation cannot afford to wait for the slow development and cautious approach of private enterprise as its chief source of a future timber supply. The foresters of the country should concentrate on getting over the immediate and large-scale extension of public forests as the major element in an adequate forest program.

THE SOLUTION OF THE FOREST PROBLEM

By R. C. STAEBNER

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THE United States was founded upon a political and social philosophy which attempted to guarantee the rights of private property, and of freedom of contract, vocation, and residence. The majority of the people of this country still believe in the fundamental soundness of these concepts, and these rights are, in the main, as sacred today as they were in 1787.

The federated states have granted to the overlying federal government organized by them certain rights and powers, but only those which are specifically set forth in the written instrument of organization and its amendments.

Free men, protected in the rights set forth above, and each pursuing what he conceived to be his own best interest, have exploited our stored-up natural resources and built up the amazing material prosperity of America today.

These individual rights and this governmental organization are the background of our past and in a large measure the reason for our present condition. They are also still effective, and any policy or program whatsoever must adapt itself to these conditions. Their modification in any large degree would take too long a time to meet the present forest problem. Furthermore, even though modification were feasible, its desirability may be legitimately challenged.

The essential physical facts of the present situation, which creates our forest problem, may be briefly stated.

An industry, organized on a vast scale, is cutting our remaining timber supply much faster than it is being replenished by growth. The yearly cut covers approximately 10 million acres, and to this industrial depletion must be added that of fires and storms, insects and disease. The total annual drain is in the neighborhood of four times the annual growth, which means that the supply of timber available for use in the forms customarily manufactured will last from 35 to 50 years. Of course this is predicted upon maintaining approximately the present gross consumption.

The most serious phase of the present situation does not lie in the harvesting of merchantable timber to supply economic needs, even though the consumption far exceeds the annual growth. It arises from the repeated sweeping of cut-over and forest-bearing lands by fire. To a large degree this annihilates the new growth necessary to fill future needs The vast scale on which this destruction occurs is shown by the fact that the average area of forest land burned over each year between 1916 and 1925 amounted to over 11 million acres, which is more than 2 per cent of the land area which should reasonably be devoted to forest production.

Except in certain special and somewhat controversial cases, it is impossible for new forests to establish themselves, and it is in every case impossible for young forests to come to productive maturity,

unless they are protected from fire. But cut-over lands when protected from fire will invariably come back to forest growth, even though there be some deterioration in species distribution from unrestricted cutting. Nevertheless the new growth which follows cutting on fire-guarded lands will, at least in fair degree, furnish the cover necessary for watershed and other environmental protection; for game; and for recreational and esthetic needs. It will also, presuming a certain amount of ingenuity, technical progress, and initiative on the part of our people, furnish the raw materials essential to an industrial civilization, and within the economic limits of value greater than cost.

Forest lands safe from fire are the *sine qua non* of continuous forest production and forest fire protection is the fundamental problem. But controlled burning where necessary for silvicultural, sanitary, or protection purposes is included in the concept of fire protection as used herein.

The solution proposed is that the federal government take over the whole burden of forest fire protection in those states which shall pass enabling acts embodying such reasonable regulations as shall restrict the wanton or unnecessary creation of fire hazards. The organization charged with the work shall be the judge of the reasonableness of the regulations, but shall be strictly enjoined from requiring any silvicultural measures except such as are incidental to or unavoidable in the necessities of fire protection.

To make the proposal definite, it is recommended that the legislation initiating this program carry an annual appropriation of 15 million dollars, with the provision that unexpended sums be accumulated for use in years of extraordinary hazard. The basis of this recommendation is that an annual expenditure of 3 cents per acre on approximately 500 million acres of forest land is sufficient for reasonably adequate fire protection. Of course this appropriation would be subject to increase or decrease as experience proved desirable, but at least the above amount should be provided for the first 10 years.

Proof that this plan is both feasible and adequate will now be attempted. It is feasible for the reasons that follow:

It raises no constitutional questions, since no state need surrender its sovereignty and no individual his rights. All activities of the federal agents must be under the authority of and in conformity with the enabling acts passed voluntarily by the states themselves. Furthermore their activity will be confined solely to forest fire protection, which is a service to the commonwealths and not an encroachment on, nor a usurpation of, their authority.

No question of property rights is involved, for the plan requires no changes of ownership. Indeed, the ownership of the land so protected is immaterial, for the public interests will be sufficiently served by productive forest lands, in so far as the indirect benefits are concerned, and economic forces will operate to make available timber that has reached salable sizes, regardless of by whom owned.

No private rights are infringed because no control of the uses of land, no control of the timber to be cut therefrom, and no interference with any other right is proposed, beyond the prohibition of nuisances in the form of unnecessary or wanton fire hazards. Nor will there be any interference with individual initia-

tive and freedom, nor with that flexibility of response to economic forces that only freedom permits.

Since no conflict of rights between individual or state and the nation is involved, no constitutional amendment is required. The legislative problem should, consequently, be relatively simple.

The plan, moreover, has the tremendous advantage of being confined to the exercise of what is well recognized as a purely public function, and is merely the extension of that function to a new field by a new agent.

Since all the efforts of the organization created to carry out this program will be centered on a single objective, the organization will always be subject to the critical test of results, and may be judged on its records and not on results promised for the distant future.

There already exists in the United States Forest Service an organization with sufficient experience of forest fire protection behind it to launch reasonably adequate protection from the start.

That the proposal is adequate to solve the problem of a permanent and sufficient timber supply depends, of course, on the definition of sufficient. The ideal of a completely sufficient supply of timber, held by many foresters, would appear to preclude all possibility of profitable forestry, for it is only as timber becomes relatively scarce that forestry on an economically sound basis can hope to exist. Moreover as the supply of wood becomes scarce the demand checked by rising prices adjusts itself to the supply, so that a "sufficient" supply of timber may mean a great many things.

This proposal is adequate in the sense that it puts all forest lands on a productive basis, and makes it reasonably certain that second growth can come through to such maturity as economic exigencies dictate. Furthermore it releases such forestry projects as are voluntarily undertaken from the heaviest risk they face. It is not denied that it will mean a lowering of our per capita wood consumption. But it is a hopeless delusion to think that we can maintain the same per capita consumption on "artificially" grown timber that we have on vast free-grown virgin stands. Of course it might be theoretically possible to maintain our per capita consumption, but the cost of so doing would lower our living standard somewhere else.

In so far as large sizes or certain species of timber are technically necessary they will be available from natural growth either in this country or other parts of the world for a sufficiently long period to allow of their reproduction silviculturally if their necessity is of a degree to make probable a price that will justify the outlays involved.

It must be kept in mind that, except in time of war, economic pressure makes the resources of all the world available to any people able and willing to pay for what they want. Wood products are not exempt from economic laws, and though it may be necessary to take them in manufactured form at a high price nevertheless such as we must have we can buy so long as there is standing timber in the world. The national forests will always have a reserve of standing timber adequate to carry us through any conceivable war.

The bulk of future wood uses will undoubtedly be in the relatively small sizes that short-rotation second growth will furnish, or as an organic raw material to be used as fibre or in completely

broken down forms, and such uses can be filled by the natural growth that follows cutting on fire-protected lands. That this same type of growth will furnish cover necessary for watershed and other types of environmental protection, as well as that necessary for wild life habitats and recreational and esthetic purposes, is hardly open to dispute.

It is hardly necessary to state that the plan is not intended to curtail any of the research or other public-service activities at present being carried on. Such work especially along statistical, technical, and economic lines will eventually furnish the knowledge necessary for sane forest taxation and for the sound development of sustained yield production that will be voluntarily undertaken as the economic possibilities are demonstrated.

In our present state of knowledge as to timber resources in this and other countries and as to present and probable future wood demands, any attempt to restrict cut to growth or to force forest production would not only be a violation of the fundamental basis of our social, political, and economic structure, but would also be economically disastrous, and probably mistaken in regard to the future timber situation as well. Moreover a real timber famine might very well be more endurable than the blighting hand of such an overwhelming bureaucracy as would be required to enforce such a scheme upon the nation.

THE BENEFICIAL INFLUENCE OF STATE FORESTRY ON THE ESTABLISHMENT OF PRIVATE FORESTRY PRACTICE

By ALEXANDER H. CRANE
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IN THE course of the exploitation of the forest resources of any country there has always come a time when the government takes a greater or less share in the business of timber conservation, utilization, and production. With this advent of the public into a domain previously occupied only by private individuals or combines, there comes the clash of private profit and forest destruction with government regulation, regeneration, or restoration; and the purpose of this paper is to show how public forestry has acted wholly in a beneficial way in two of the states of the Commonwealth of Australia, which have been selected for the purpose of illustration.

I am dealing with Queensland and South Australia because of their extreme positions in the matter of indigenous timber supplies. Of the six states of the Commonwealth, Queensland alone possessed a natural softwood resource in the araucarian jungles of the southeast and the kauri pine stands of the southern coastal sands and the mountain forests of the north. However, this pine resource was very limited, being composed of a thin stand scattered over a total original area of no more than 3,000,000 acres. In addition this state possessed a rich miscellany of cabinet woods from its jungle forests, not found in the other states.

All the states, however, are richly endowed with high-grade hardwoods except South Australia, where the tall dense forests characteristic of Victoria on the east, and West Australia to the west, do not occur. Here was a state deficient in all forms of timber supply, so that it could not substitute eucalypts for softwoods as has West Australia. The latter state, while cutting no softwoods of its own, in 1926-1927 imported (1) but 17 board feet of sawn softwoods per capita; Queensland imported 16 while cutting 90 board feet per capita; and South Australia brought in 128 board feet per capita, while a further 3 feet were cut largely from the early returns from forest plantations, a figure which will increase rapidly in the near future. Thus the positions of Queensland and South Australia may be appreciated, as the above figures lie very close to the average for the period 1910-1927.

With South Australia I shall deal first. It was only natural that very early in the state's development the need for a native timber supply should make itself keenly felt; so that in 1882 the government embarked on a policy of planting

areas of poor indigenous tree growth. A gradual expansion took place until today an annual program of over 5,000 acres has been attained and the needs of the state are being met. Cutting has begun on the early plantations.

During this period the practicability of forest establishment has been demonstrated by the state. Thriving forests over 31,000 acres (4), from a few inches to 90 to 100 feet in height, are available. These not only represent a considerable wage bill in the past, but secure to the people a large future revenue from moneys previously expended on imported lumber. In the process of building up the forest estate some 60,000 acres (4) have been purchased representing mainly poor sandy areas practically unproductive of revenue otherwise.

At the same time, the marketing of the at first despised "insignis" lumber has been carefully nursed to success. By careful grading, seasoning, and kiln drying (pioneered by the state), the pine has been placed on the South Australian market in competition with the imported Baltic deals, Douglas fir, and Pacific Coast spruce and pine.

For forty-seven years the state has been at work, creating a forest value on poor soil areas, and with marked success; for the extremely rapid growth of *Pinus radiata* and other conifers has prompted the formation of six private (4) corporations (largely of small bondholders) to join in the planting work. Private enterprise over forty-four years gave no sign of taking up the work. Indeed, the task was impossible for the individual when he had cut out the low-grade hardwood forest. Rightly the public assumed its responsibility, and now by building up a considerable supply for a market organized by the state it has made possible the entry of the private corporation of small investors into forestry. For them it affords a tried technique, a demonstrated result, and a market ready-made for profitable, co-operative participation.

Queensland presents a more varied picture. Here there has been a rapid exhaustion of the indigenous, high-grade pine supply, particularly of that under private control. Meantime stumpage prices have risen rapidly and steadily.

The state, being the owner of a large proportion of the total timber supply, has been constantly in the market in competition with the owners of private timber, but it is a well-established fact that the state's participation has worked consistently to the advantage of private forestry by establishing a higher level of stumpage prices. The price of timber to the consumer has not been increased by state forestry since these ultimate prices are governed by the general laws of supply and demand for finished lumber; but the margin for stumpage, which under private exploitation would have been kept abnormally low, has been adjusted on a fairer basis. A brief outline of the establishment of stumpage values, shared by the small holder, hand in hand with the development of organized sales by the state, will illustrate the service rendered to the private producer as well as to the country.

The year 1904 saw the inception of the Queensland Forest Service. The position of the forest industry at that time can be judged from the statement by the Director of Forests in 1905 (5) that "allowing on softwoods a royalty

(*i. e.*, stumpage price for immediate cutting) of 8d. per 100 square feet ($1.60 per M.)," and also " on the basis of the Statistician's figures, two-thirds of the timber in the state must have been cut on private land."

By 1913 we read (2) " during early days of settlement and even in quite recent years, many areas well-timbered were selected, and having been stripped of the marketable timber, are now put to no use by their owners."

In the 1916 report (3) there is evidence of protest by purchasers of stumpage against a royalty which had now reached a maximum of $14.20 per M. Yet since the inception of the Department in 1904, all sales were made at public auction with a minimum or upset price fixed by the Department but controlled by the ruling prices offered for log timber. It is significant that, whenever there was free and genuine competition, the records show that prices above the Crown upsets were freely offered.

Again in 1920 (8) private forces were opposing the upset prices of the Forest Service which advocated their retention in order that a more rational and a more complete utilization of the forest resources might be made, that " tops " might be taken from the forest along with the butt logs, and that the large supply of secondary species might be tapped. Conservation of resources, and very limited resources at that, was the public plan opposed to private exploitation, and was achieved by getting better stumpage prices.

By 1925 (6), milling interests were making agitation against any extension of the policy of milling *in situ*. A request was made by representatives of the millers that preference in log deliveries should be given to town and city mills as against bush mills, and that logs be sold on truck and not at stump. In the same year not one bid above upsets was received in the sale of over 50,000,000 feet of Crown timber. Right through, increased supplies of public timber at lower rates were sought. Instead of yielding, the Forest Service (6) in 1925 published its plan for rationing the fast-disappearing pine resource over the next 30 years, in order that the industry would have a definite working basis. Slowly the imports have begun to grow. It would have been very easy to have yielded to the popular request and sacrificed the public timber, particularly as the cut from state lands has exceeded the private cut since 1924-1925. The latter is expected to fail completely in 1940 and to be insignificant long before that.

The price increases (9 and 7) may be summarized as follows:

Year	Stumpage	Lumber
1905	$ 1.60	$ 36.00
1908	4.00	56.40
1911	7.50	66.00
1914	9.00	72.00
1918	10.00	108.00
1924	12.20	108.00
1929	14.00	138.00

The stumpage figure is the average price for all classes of logs for the year, and is only approximately accurate. Wide variations occur depending on quality, size, and location. For example, in 1929 prices ranged from $70 per M. for " ply specials " down to something under $5 for case timber, with an average of $14 as shown. The lumber price given refers to joinery class dressed pine 6 inches by 1 inch.

The significant features are the increase in lumber values, and the elimination of the private supply by exploitation in spite of wide margins available for the practice of forestry.

It is generally accepted that the high price of Queensland pine lumber is not the product of the machination of the Forest Service. It is due entirely to economic trends—diminishing supplies and increased prices due to war conditions and subsequent reorganization on the high standard of living obtaining. Yet it is indisputable that the work of the Department, along with its presence in the field with supplies of an order sufficient to create a considerable monopoly strength, secured for *both the private timber producer and the state* a more rational utilization and a proper share of the increase, and contributed very greatly to the distribution of the margin of profit fairly between operator and producer.

Lumber prices cannot be maintained at a high level by mere monopolistic restriction of supplies or inflation of stumpage. Instead, stumpage depends absolutely on the utility of the finished wood product; and for this pine the utility is very great.

In the much more plentiful hardwoods the same realization of value could be traced; but the state has not finished its good work here in the preparatory stage to forest production, and of this, rather than the hardwoods, I shall write. An adequate stumpage value has been attained by a long persistent struggle, and this makes possible the growing of new timber crops in areas of subtropical weed growth with its high attendant cleaning costs. At the same time the art of crop production has been studied intensively, a highly specialized planting technique evolved for the pine, and a regeneration process found for the hardwoods. The public today has 4,300 acres of plantation established, and over 45,000 acres treated for natural reproduction. Due to stringent financial conditions in a state with 900,000 people spread over its 670,000 square miles, and the lack of a proper forest sentiment among the people, appropriations for this work have been inadequate to meet the future needs of the country. Yet the foundation has been laid, and in 1928, although private forest activities were "negligible, considerable interest is awakening." I quote from a paper presented (10) to the Empire Forestry Conference, Australia, 1928, by the Forest Service:

"Two forestry companies have been formed recently; the Brisbane City Council is considering the planting of its water supply areas; a Forestry Club has been established in Toowoomba, and one or two public schools are planting small areas, as is also a sawmilling company at Corinda, near Brisbane."

Private enterprise so far has made no adequate attempt to supply the timber needs of Queensland. Under the inspiration and leadership of the state, private interest may be initiated and nursed along to take its due share in the work, and by coöperation reap the benefits won by the public in value, in method, and in practice.

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A SLANT AT THE FUTURE

By ALLEN S. PECK

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THE PAST quarter century has seen most of the progress that has been made thus far in forestry in this country. The establishing of the national forests, the development of a widespread coöperative effort under the stimulus of government subsidy and leadership, and much preaching and propagandizing on the subject of forestry are beginning to change it from a mythical cause into a practical factor of our national life.

After a generation of intensive effort by an ever-growing group of foresters trained for the profession, it would not be surprising if young foresters who are just embarking upon their professional career should begin to wonder what is ahead, or that the older ones should likewise wonder what really has been accomplished to justify the faith and enthusiasm with which they started out.

Twenty-five years ago the talk was all of devastation and timber depletion. A timber famine loomed ahead and the very year of its materialization could almost be figured out mathematically. Strange to relate, we now find the lumber business facing a serious condition resulting from overproduction, and instead of the timber famine our lumber salesmen are in keen competition with wood substitutes.

With all the talk and preaching we find that very little real progress has been made in the way of bringing large timberland owners to the mourning bench. While some have been converted and are honestly endeavoring to handle their timberland with a view to sustained yield and future crops, most of them are still studying with skeptical if increasingly curious attention the balance sheets of their business and the figures which are presented to them by hopeful foresters. Compound interest, the uncertainty of future markets, confiscatory taxation, and fire risks make them see red where we should like them to see black.

Lumbermen who invested heavily in Pacific Northwest holdings hoping for the materialization of the conditions which the foresters feared and looking forward to the time when they would have cherished lumber supplies to disgorge upon a rising market, are now finding themselves forced by taxes and interest to liquidate in the face of overproduction, heavy transportation costs, and substitute products.

The practice of forestry in the northeastern part of the country, where second growth on abandoned farms and timber holdings had given every encouragement to the forest-minded, is now being discouraged by the inroads of Northwest Coast material which is being forced onto every available market.

While there is a scarcity, to be sure, of many old favorite kinds of timber, we find adjustments being rapidly made to the substitution not only of other species and grades but of other materials. Trees find themselves competing with corn stalks. Chemists have found out what to

do with cellulose. Now they are hard at work to determine what to do with lignin. With the exhaustion of favored species and products and the use of substitutes, the demand for the old timers falls off and quickly dies, and now it is a fact that the little odd bits of white pine which are occasionally logged in the Lake States are an embarrassment to the producer in finding a market.

Wood was used in the past for many things simply because it was handy and not always because it was the best thing for the purpose. Our civilization was, to be sure, built on wood but with the progress of the mechanical age we are becoming less and less dependent on a material which in the days of handwork was indispensable.

Was Uncle Joe Cannon right when he said twenty-five years ago at the time conservation measures were being agitated in Congress that there was no need to worry about the future wood supply of the nation because when it was exhausted science would find substitutes? Are foresters now faced with the necessity of bolstering up their faith with other arguments than the imminence of timber depletion? Do the lessons taught by China and Spain lose their force in the light of present conditions?

Are federal foresters wrong in their time-honored practice of cutting the national stands of timber selectively with a view toward favoring the choice species for the future crop? Are we wrong in basing management plans upon the production of clear sawtimber when it is beginning to be apparent to the most casual observer that the boards of the future are going to be synthetic boards and that the greatest return per acre will be secured through the production of the greatest volume of cellulose per acre; when it can be fairly assumed from present indications that a heavy stand of young trees of inferior but rapidly growing species will return more per acre than a fine stand of clear sawlog trees 150 to 200 years old, or even 80 years old?

While it would be foolish to answer all of these questions with an unqualified negative, I make bold to say that the forester's instinct for trees is sound. We may be pardoned, to be sure, for changing the emphasis a little and for putting the soft pedal on depletion. The doctrine of depletion is no longer applicable as it was twenty-five years ago, the very energy with which it has been preached having itself helped to change the conditions to some extent. I do think, however, that we are justified in looking forward with confidence to a forested future in a land clothed with trees and peopled with forest-minded folk.

Trees we will have regardless, even though the sawlog may be extinct and unheard of and though the younger ones of us may live to see the last sawmill behind glass in a museum. It may be that commercially trees will be looked upon only as producers of cellulose and will be used industrially only in disintegrated form, and it may also develop that less area will be required to supply our wood needs than has been commonly estimated. However, our *forest* needs are something different and in a class apart from our mere *wood* needs. It is unnecessary here to go into the many and various ways in which trees and forest cover affect the welfare and happiness of the human race but they are numerous and we are keenly conscious of them.

Another thing, the total aggregate area needed is not the whole story. Distribu-

tion is important, and so are localized supplies. The importance of this will grow with the growing intensity of population. No region or community of fifty years hence will want to be without the beneficent effects of near-by forests. Quantity production may concentrate output on a limited acreage where small stuff may be grown on short rotation for maximum cellulose volume per acre. Our present care in the selection of the most valuable species may look foolish. Still we shall want forests—forests of high timber—large trees for beauty and shade, game cover and recreation grounds.

It would seem that there is a time coming soon when the forest management problem will be comparatively simple and when the chief activities to engage the forester's attention will be protection from fire, insects, and diseases, and the planting of waste lands. The forester is going to find himself a protector and conserver for a period of years. His job may not be just as he is learning to view it from the windows of the school room. There will be little use for European practices so far as raising tree crops goes. During this period, which may last for several decades and perhaps longer, those forms of human use which may be grouped together for convenience under the term recreation will alone justify forest protection, to say nothing of other contingent benefits of the forest such as the protection of headwaters of streams and prevention of erosion. Of the utmost importance and interest to the forester during this time which is coming will be the correlative activities of the forest realm,—the study and conservation of wild life, the handling of domestic stock, the direction of human use, in a word, all-around land management.

Wood has the advantage over mineral resources in that it can be grown and the supply replaced as often as may be necessary. It would seem reasonable to suppose, therefore, that as certain minerals become scarcer and hence more expensive, the tide of utilization may swing back toward wood products eventually, so that wood or at least wood cellulose and lignin will become very important again, perhaps even more important than lumber has ever been in the past.

Since the pressure of demand will make private landholders manage on a short rotation, indications are that the nation will have to depend upon government reservations for the kind of forests which it will want for recreation and other contingent uses. This would lead logically to a policy of buying up big timber stands from private owners to be kept under permanent protection as great reservoirs for the future, "just in case," and to satisfy our national desire for woods to play in.

The government forester in 1950 will be likely, therefore, to find himself managing and protecting playgrounds, pastures, and watersheds, while the forester in private employ on the contrary will be more apt to be interested in the relatively simple problem of raising the greatest possible volume of wood cells per acre with the most rapidly growing species available.

SOME PROBLEMS OF SILVICULTURAL RESEARCH[1]

By WILLIS M. BAKER
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THE PURPOSE of this paper is to call attention to the urgent need for more and better work in silvicultural research, and to suggest some ways in which this may be accomplished.

The past quarter century of American forestry has been an era of promotion. The promoters—foresters and allied conservationists—have been successful in selling the idea of forestry to a public which was ready for it and which wanted it. Reaction against the previous era of exploitation had set in; anything pertaining to conservation of natural resources was popular. To go to extremes seems to be an American characteristic.

Some of the early foresters, working under discouraging handicaps, overcoming the obstacles and solving the problems of their day only by the most persistent and self-sacrificing effort, may not agree that the forestry movement has gone farther in less time, with less real effort behind it, than any other similar bit of advancement in American history. Yet what other conclusion explains the truly remarkable acceptance of forestry within the past twenty-five years? Surely we foresters cannot conscientiously claim that it has been due to a preponderance of brains and ability within our profession. If we have a surplus of anything, it is optimistic idealism, blended with a dangerous strain of impracticality. We must accept the fact that the forestry idea has been relatively easy to promote.

Until recently, however, the forestry movement has not prospered financially. The people approved of the idea as long as it did not cost them anything, but they were hesitant to spend their money for something that promised only rather indefinite benefits in the remote future. Then the hardships and privations of the World War period opened their eyes to the real danger of a shortage in any basic commodity, such as wood. The inflated costs of everything lent weight to the arguments of foresters warning against the coming timber famine. The forestry boom became strengthened by economic experience.

Following the War, with general prosperity, larger incomes, more time for leisure and play, and the increased use of automobiles over improved highways, millions of people learned to use the forests as their playgrounds. The public now had another direct, personal interest in forestry, which promised to conserve and perpetuate these playgrounds.

This sort of selfish interest has been capitalized for immediate financial support for forestry, as well as for other governmental enterprises. Funds are now being appropriated in steadily increasing amounts for forestry, and it seems to be prospering.

[1] Presented at the annual meeting of the Society of American Foresters, Des Moines, Iowa, Dec. 31, 1929.

After any promotion progresses to the point of actual investment, one or two things happens. The promoters either produce results which justify the investment, or the bubble bursts. Investors cannot live on promises indefinitely, and forestry will prove no exception to this rule. The time is dangerously near when foresters must lay aside their pens, put on their old clothes, get out into the woods, and grow timber. The alternative is to resign and join the Wild Flower League.

Forestry is essentially the growing of timber crops and their utilization. The use of waste land, the conservation of water resources, and forest recreation are important, but not the major issues. Forest land must be set aside or acquired in sizable units for efficient management, but acquisition is only a preliminary step in the forestry program. The protection of forests against fire, insects, and disease is vitally important, but merely to make timber growing possible. Roads, trails, lines of communication, headquarters, improvements, personnel organization, maps, working plans—all are necessary but beginning steps in the management of forests. The growing of the forest crop under adequate protection is the major part of the forestry program, rivaled in importance only by the harvesting and utilization.

Because the activities of acquisition, protection, and improvement necessarily precede silviculture in most management programs, and are of themselves highly important, they have naturally occupied the entire attention of many foresters, who now find it easy to overlook or neglect the real purpose of forestry—timber growing. Under the circumstances surrounding our gradual forestry development this is a perfectly natural sequence, and there would be no occasion for alarm, if, at the proper time, silvicultural management could be applied to the forest as readily as roads or fire lines can be built. But unfortunately this cannot be done.

To learn the best methods of growing timber crops and how to apply them in the woods requires years of careful study and intensive investigation, which we call by the awe-inspiring term of silvicultural research. Many a two-fisted and essentially hard-headed forester smiles disdainfully at the very thought of such technicality. But he who claims that only protection is needed to grow our future forests would be perfectly satisfied to operate a 50 per cent efficient factory or business, as indeed many people do, until they "go broke."

And so, in a rather round-about fashion, we come to the first, and in many ways the most important, problem of silvicultural research—that of convincing the entire forestry profession of its importance and urgency. At the present time a considerable volume of more or less satisfactory research is being undertaken, but in general the profession merely tolerates this effort, regards it as impractical, and fails to give it wholehearted support. There seems to be surprisingly little interest in or demand for improved research methods, which are unquestionably necessary for the progress of all forestry. Why is this?

It has already been pointed out that many foresters engaged in the preliminary work of publicity, organization, or protection have never had the opportunity of attempting to grow timber, and therefore it is very natural that they have little interest in this branch of forestry, or

little conception of its problems. Many of the so-called leaders in the profession, men of position and prominence, are unfortunately in this class.

Another important reason for the present lack of adequate support for silvicultural research is that the results of such work in the past have been, with a few exceptions, so generally unsatisfactory. Many investigators have been enthusiastic amateurs, too eager to startle the world with their findings, to have the patience, even if they had the ability, to solve their problems conclusively. Published reports of investigation have often been both superficial and inaccurate, or not infrequently so ultra-scientific in terminology that the average forester was entirely incapable of understanding them. This state of affairs is to be expected in a new profession like forestry, but unfortunately it is difficult to restore confidence after it has been destroyed.

With the last few years a demand for more silvicultural research has arisen in many regions. Those foresters actually working in the woods have run up against problems beyond their ability or resources to solve, so they have called for help. As a result, more research organizations have been established, and they have generally started to work along the lines of fundamental research. Naturally enough the workers have been carefully selected for their scientific ability and technical training; in most instances only fundamental, basic problems have challenged their interest as worthy of their efforts. The more simple problems capable of immediate solution, often the very problems for which the woods foresters were calling for help, have usually been ignored. As a result, those foresters have been somewhat disillusioned, and their confidence in research is shaken, just as the public's confidence in all forestry may soon be destroyed if results are not forthcoming. If foresters begin doubting one another, what can uphold the public's faith?

Basic, fundamental research is absolutely essential if our forestry problems are to be conclusively solved, and this sort of work requires years of painstaking investigation by the most capable scientists. Research which does not go to the beginning of things is not worthy of the name. Our silvicultural methods will be successful only to the extent that they are based upon fundamental research, unless the element of luck favors our otherwise hastily drawn conclusions.

Research organizations would seem to have fallen heir to the unenviable job of trying to please everyone. They must be honest with themselves and their work, which begins with fundamental investigation, but at the same time it is most necessary, from the standpoint of expediency, to produce some results immediately, if they are to enjoy the support of the profession which they deserve, and must have. Foresters who are dealing with problems of board feet have little patience with research work on root hairs. They demand some board-foot studies and results; if they do not get them very soon, all research will suffer. Those foresters guiding the destinies of research must be politic as well as technical. A conscientious investigator is not necessarily a competent executive.

Another important problem of silvicultural research is that of better cooperation and correlation of effort among the workers. Our silvicultural problems are so many, and their solution is so

urgently needed, that to waste both time and energy by duplication of effort through lack of efficient correlation, is dangerously short sighted. Yet that is exactly what is happening. Many investigators are needlessly struggling with problems that have already been solved. Similar studies undertaken simultaneously in various regions could be concluded with better results in a fraction of the time, if the various workers engaged were fully advised of the progress of the work of others. Every forester attempting to manage an area of woodland is learning facts which should be added to the findings of research. In many instances it is just the kind of practical information which the research worker needs so badly to round out his own scientific investigations.

Coöperation and correlation of effort in silvicultural research would seem to be a logical function of the research organization now established in the various regions. Some of them are working to bring this about, while others give no evidence of similar activity. Better cooperation and correlation of effort would be an actuality everywhere if there were a stronger professional demand for it, but until this comes about we shall continue to flounder in learning the why and how of our forestry job.

To fail to take advantage of opportunities is wasteful; foresters, already behind schedule, cannot afford to waste time or energy in putting over their job. Waste is due to lack of organization, and organization is the function of the Society of American Foresters. Silvicultural research is not the only branch of forestry now suffering through lack of efficient professional organization. When every member of the Society comes to realize that his professional welfare and prosperity, as well as the ultimate success of forestry, depends entirely upon his interest and the success of his efforts to bring about a stronger, more efficient professional organization, then, and only then, will results be forthcoming.

The third major problem of silvicultural research, and the final one to be considered in this paper, is that of the practical application of results. Many a research worker is entirely satisfied with his conclusions based upon purely silvicultural observations of small plots. In the class room or office these conclusions sound practical and convincing, but attempt to apply the methods recommended in a practical way to a good-sized operation, and one is overwhelmed by many important details never even dreamed of by the investigator. Silvicultural methods are so closely tied up with other problems of management and utilization, that the investigator who would have his results practical in application must go beyond the limits of pure silviculture in his studies.

If every research organization were directly responsible for the silvicultural management of a sizable area of forest, and were obliged to prove the practicality of its conclusions before submitting them to the profession, the final results would be infinitely more valuable, and the present criticism of impracticality directed against much of our research would cease. Most research organizations now recognize this fact, and many of them are applying the acid test of practical application on lands controlled by them, or loaned for the purpose by willing cooperators.

As an example of the benefits of the test of practical operation applied to silvicultural theory, let us consider briefly the project of thinning southern white cedar (*Chamæcyparis thyoides*) on the state forests of the coastal plain region of New Jersey. This project is selected, not because it is in any way an outstanding example, but because it is one of the few with which the writer, himself an amateur investigator, is familiar.

Several years ago the project was started by the establishment of small thinned and check plots in the characteristic dense stands of white cedar found in the fresh-water swamps of southern New Jersey. Even-aged stands from 25 to 60 years of age were measured and thinned, to determine yield and the possible increased growth after thinning.

About this time an act of legislature provided that all income from the state forests should be set aside and appropriated only for the development and maintenance of the state forests. This provided a most valuable incentive for attempting to derive profits from silvicultural work formerly undertaken purely as studies. Heretofore no attention had been paid to the possible salvage of products, as the sole interest lay in the future growth after thinning. A similar narrow viewpoint has been characteristic of much silvicultural investigation in this country.

In thinning young stands of cedar up to 40 years of age, from 2000 to 3000 trees per acre, ranging from 2 to 6 inches in diameter, are removed. Investigation of market conditions showed that the thinned trees could be readily disposed of, the smaller trees as bean poles and rustic furniture poles, and the larger ones as arbor poles and fence posts. But the products from the more numerous smaller trees brought a relatively low price, whereas the larger and more profitable products were so few that the total profits did not pay for the cost of thinning.

Further investigation brought to light the fact that the medium-sized trees, 3 to 4 inches in diameter, formerly thrown in with the smallest for bean and rustic poles, could be used as shade-tree stakes to support newly planted shade trees, for which expensive sawed lumber stakes had been formerly used by most shade-tree commissions and municipal-park departments. At a price three to six times as great as that received for bean poles, these shade-tree stakes could compete on the market with lumber stakes, and in many ways were superior in quality. The job then was to introduce them, and this has been done so satisfactorily, in connection with the state forest cedar-thinning project, that within five years the annual sale of shade-tree stakes has increased from 400 to approximately 20,000.

The successful promotion of cedar shade-tree stakes has made cedar thinning profitable, and therefore practicable. In the three years up to July 1, 1929, a total of 26 acres of cedar was thinned, yielding 89,000 products cut and sold for $8753.99, with a net profit averaging $37.00 per acre. Demand for all kinds of cedar-pole and log products has been stimulated by the work, and is steadily increasing. All steps of the thinning operation have been carefully studied and analyzed, with the result that operating methods have been materially improved from time to time, and costly mistakes are being remedied. In the future, net profits are expected to exceed considerably the present average profit of $37.00 per acre.

It may be of interest to observe that approximately 75 to 100 man-days labor are required to thin an acre of cedar swamp and market the products.

As yet the study has not progressed far enough to determine accurately the age of the stand at which thinning is silviculturally desirable, although from the standpoint of growth alone, it is probable that early thinnings at from 25 to 30 years of age will be preferable. But the practical application of the thinning experiment has proven that, in consideration of thinning profits, the work should not be undertaken before 35 to 40 years of age, when the profitable shade-tree stakes form the highest percentage of the products removed. Also the poles in younger stands do not have sufficient heartwood to make them durable in the ground, and the bark of younger trees is too immature for rustic poles. These facts, which control the practicality of the project, would never have come to light in the usual theoretical studies based upon small plots.

Still another important factor leading to success or failure was discovered by this operation. In thinning small plots close to the edge of the swamp, it seemed perfectly feasible to carry out the small, light-weight products by man power. But as the operation increased in area and progressed deeper into the swamp, this was found to be much too costly. The problem was finally solved by removing products in a light car running over portable sections of light steel track, at a fraction of the cost of the former method. It was also discovered that extending the track 100 feet or so beyond the edge of the swamp to high ground eliminated the costly delays in hauling previously encountered, when the automobile truck was frequently stuck in the mud. This factor alone added several dollars per acre to the profits.

Meanwhile the silvicultural study of growth and yield of white cedar goes on, in no way handicapped by the extension of the project to include the practical application of the silvicultural methods advocated. The final conclusions, when they are reached, should be infinitely more valuable because of their test.

This cedar thinning is but one of many similar examples of the manner in which silvicultural investigative projects are undertaken on the New Jersey state forests, now comprising an area of 30,000 acres. We believe that for some time to come the learning and testing of silvicultural methods forms the most important part of our job. What we do now in actually developing these forest areas will soon be forgotten, but what we learn about growing and using the forests will be of value for all time. Convinced of the importance of silvicultural research, our men coöperate with each other and with other research agencies to the fullest extent possible, in order that no time or effort may be wasted in obtaining results. Last but not least, we attempt to test our theories by practical application, so that our final conclusions may be really usable. That we are meeting with some measure of success in these efforts is attested by the fact that our income, derived largely from the sale of products cut during silvicultural investigations and forest improvement projects, is steadily increasing year by year, until in 1929 24 per cent of the total cost of all state forest administration, development, and improvement work of all kinds was paid for from this income. If our silvicultural methods

were not practicable, the net profit income would decrease rather than increase. While carefully watching the costs and profits of our methods, the purely silvicultural aspects of the studies are not slighted. Perhaps some will object to our attempt to measure progress by the dollar sign, but after all, what other unit of measure can there be for forestry?

In attempting to point out some of the problems and needs of silvicultural research, perhaps the writer may be justly accused of going to extremes in his criticisms of present standards. It is true that much progress is being made today by many able research workers and efficient organizations, along all of the several lines mentioned in this paper. It is equally true that entirely too much time and effort are still being wasted through inefficiency and lack of organization. This fact justifies the strongest criticism, if it be constructive.

ENVIRONMENTAL CONTROLS FOR GAME THROUGH MODIFIED SILVICULTURE[1]

By ALDO LEOPOLD

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FORESTRY and game management, like agronomy and animal husbandry, deal with the coördinated production of plant and animal crops from the same land.

In the case of agronomy and animal husbandry it is universally recognized that neither crop would return a profit to the landowner without the other. An organized process of give-and-take has been built up between the two activities. This process begins in the system of research and education in the agricultural colleges, and ends in the daily operations of the farmer. The two are one and inseparable.

This paper is a plea for hastening the development of a similar organized process of give-and-take between forestry and game management. Measured against zero, it is clear that such a process is already under way, but measured against the need and the opportunity, it is clear that its development so far is much too slow.

There are three reasons why foresters have a special responsibility for speeding up its growth:

1. Game is the only land crop, aside from timber, which is best produced by the use of natural species in a natural environment, by means of a low-yield, low-cost technique. All other land crops raise artificial varieties in a manufactured environment, by means of a high-yield, high-cost technique. Game and timber yields are based, to an exceptional degree, on skill in giving slight and inexpensive guidance to natural processes. Foresters should, therefore, readily understand game management.

2. Forestry from its very inception adopted the quantitative method. Ornithology and mammalogy have only recently begun to shake off the incubus of the merely descriptive method. Many of the quantitative conceptions of forestry can be transplanted directly to the game field.

3. The "free timber" idea began to disappear from American conceptions of forest economics as early as the Revolution, whereas the "free shooting" idea has barely begun to be challenged as a working basis for game production on private lands. In both fields, the fundamental present need is financial incentive for private production. Forestry has the idea of salable crops needed by game; game can furnish the additional revenue needed for forestry.

Hence my plea that foresters contribute more actively to the development of game management.

Let me say at the outset that the repetition of formulas like "The forest is the home of the game" is not a contribution

[1] Presented at the annual meeting of the Society of American Foresters, Des Moines, Iowa, Dec. 31, 1929.

to game management. It would be about as helpful if agronomists said: "Raise plenty of crops and your livestock will prosper." Even the layman conservationist may eventually tire of such generalizations, unless the revolving decades bring some differentiation of what we mean. We must remember that "all generalizations are false, including this one." Progress in any field may be measured by the rate at which generalizations are broken down and reformulated.

In support of these assertions, I offer four specific local problems illustrating the differentiation of the forest-game relationship.

Quail Crops from Cut-Over Southern Pine Lands

Stoddard has shown that thick broom sedge excludes quail and encourages cotton rats.

The trend of forestry seems to favor thinning the broom sedge to control fire and admit reproduction, but to oppose doing this by light burning or hogs.

Greene has shown that it can be done by cattle, but Stoddard finds that summer cattle grazing excludes quail by excluding the native legumes which are their food.

Quail and cattle are possible by-products which will enable the owner to carry cut-over land until pulpwood and sawlogs are ready to cut. The quail crop alone has an established market value up to 15 cents per acre per year gross, which would pay for all fire control, or part of the taxes.

We have, therefore, this situation: Quail and cattle would pay the costs of starting forestry on southern pine cut-over lands if we only knew how to use cattle to thin the sedge without destroying the quail food.

A little further experimentation might solve this problem. There are two promising leads. The first is to replace the indigenous quail foods (whose vulnerable point is that they are upright annuals) by procumbent exotic legumes, if possible perennial. Cattle would be less likely to prevent the fruiting of such plants, which would not only feed the quail but also the cattle and in addition enrich the soil.

The other lead is to offset the loss of indigenous quail foods by the cultivation of small, fenced food patches, or by increasing the width or number of ploughed fire lines. Ploughed fire lines automatically grow weeds, most of which are quail feed. Both of these things can be done; experimentation is needed only to determine minimum costs.

Here is a single research problem vitally affecting many southern states, and therefore on its face suitable for federal initiative. It calls for the coördination of three kinds of agriculture, and therefore on its face it is suitable for attack under the McSweeney-McNary Act. It is discouraging that appropriations under that bill are not sufficient to attack it, but still more so that effective requests for such appropriations are not yet, to my knowledge, before Congress.

We still have quail in the southern cut-over lands, but only where grazing is accidentally too light to totally exclude quail foods, or where the presence of fenced fields accidentally provides enough ungrazed area to replace them. Such accidental crops are not a satisfactory substitute for management in either game or forestry.

One ramification of this same problem is to determine what intensity of thinnings in second-growth southern pine admits quail feeds. If quail are to be grown as a by-product of forestry, it is important to know what crown densities must be classed as blanks, and whether stands can be opened up enough to become quail ground without sacrificing increment in volume or grade yield of lumber, or volume of oleoresin production, Quail-feed quadrats established in existing forest sample plots ought to yield an answer to this problem at little cost.

Shape and Size of Plantations as Affecting Game Crops in the Lake States

A large planting program, at least on public forests, is I hope in the offing. Every layman conservationist is using the game-covert argument in its favor. Planting plans are in the making. If we are to make good on the covert argument, these plans must take game into account. Yet neither game managers nor foresters seem aware that the geographic pattern of these plantings may vary their game benefits by several hundred per cent.

The theorem underlying this assertion is briefly this. Maximum production of game is attained only where the interspersion of environmental types is such as to bring each of them within the "cruising radius" of the species. Thus deer may have a daily cruising radius of say two miles, and a seasonal one of say fifteen miles. They may require in summer cut or burned land for feeding, water for fawning, thicket for "bushing up," and open land to escape flies. In winter they may require cedar swamp for yarding. In the fall, oak or beech mast, if not a requirement, is certainly a great advantage. Does the range afford, within their daily and seasonal radius, these daily and seasonal needs? The trend will be for deer to occupy only such ranges as do so.

Of course nobody really knows their needs or their radius. We may safely guess, however, that interspersion is usually too little rather than too great, and that lumbering and fire have made it more so. It is generally believed that the remaining yarding grounds do not match the summer food supply.

Plantations are, from the game standpoint, an artificial augmentation of the thicket type. If these thickets are a township, or even a section, in size, their centres will probably constitute blanks for game, being too far from the other types to be usable. On the other hand, even a single forty of such thicket might become a new yarding ground if adjacent to or interspersed with browse species.

A more extreme case is that of ruffed grouse. The cruising radius is unknown, but it is certainly less than in deer, while the environmental types which must be reached are probably similar in kind and variety, and include the coniferous thicket. Therefore the interspersion required for maximum population is probably much greater—too great to be silviculturally attainable. In species like grouse the covert theorem may probably be stated in very simple terms: producing capacity is proportional to the *sum of the peripheries* of the necessary environmental types.

We have here a problem in ecology which cannot possibly be solved before large-scale plantings begin. Any modification of the planting plan must therefore be based on guesses. A guess, however, is better than to be unaware of the problem.

Furthermore, a simple study of game foods would help much. Grouse foods have been studied in the East, and deer foods in the West, but no adequate work has been done in the Lake States on either species.

Later on, the interspersion of cuttings will present the same problem as the proposed plantings now do.

Obviously planting and fire costs will increase with interspersion, but insect and disease hazard will decrease. We must guess at a happy medium between these primary considerations on the one hand, and game-producing capacity on the other.

Reproduction of Browse Species in Western Yellow Pine

Since the cessation of fire and the reduction of grass competition through fire control and heavy grazing, great areas in the national forests of central Arizona and central New Mexico have established a fine catch of western yellow pine and juniper reproduction. The juniper in particular is invading miles of country heretofore treeless.

At the same time grazing has eliminated reproduction of mountain mahogany and live oak, and even killed the smaller arborescent stock. The indefinite continuance of present conditions will clearly eliminate these species.

Part of the present grazing is done by deer, although the original damage probably came from cattle. Cattle have been reduced to a point where the grass is coming back, but the deterioration of the browse continues unabated.

From the livestock standpoint, it is desirable but not necessary to reproduce the browse. From the deer standpoint the browse is essential. Looking twenty years into the future, we shall have a great thickening of pine and juniper coverts, and an eventful increase of mast feed in the form of juniper berries and piñon nuts. But mast is not dependable as deer food because crops are sporadic and do not last the winter. The bread-and-butter species are liveoak and mahogany, and these will be gone. In short, forest administration to date has expanded game coverts but reduced the bread-and-butter deer feeds.

For turkey, the outlook is better, because they do not need mahogany browse.

Since much of the land is too rough and poor to be clearly more valuable for forestry than recreation, should not the future balance of environmental elements for game be recognized in forest administration? The resulting research problem will be a baffling one, but one well worth attempting to solve. The parallel problem of how to reproduce pine on grazed ranges was likewise baffling, but is now well in hand.

Game and Grazing in Corn-Belt Woodlots

It is conceivable that more or less game could persist without any forestry in all of the "real" forest regions, but it is certain that no forest or brush game will persist in the corn-belt without forestry in the corn-belt woodlots. Yet here where the interdependence of forest and game crops is greatest, where the cash value of each is most distinct, and where each is menaced by a common enemy—grazing—neither game managers nor foresters have progressed beyond the pious repetition of phrases to the effect that "the woodlot is the home of the game."

What kind of woodlots? What kind of game? Why?

In the first place the corn-belt species which use timber at all consist, with the exception of squirrels, of brush-using, not timber-using species, namely quail, rabbits, and pheasants. Therefore selection forest has no game value except in its brush periphery, whereas coppice or group-selection forest has a game value not only in its periphery, but throughout every acre of the younger age classes.

In the northern part of the corn-belt the game value of any woodlot can be greatly enhanced by underplanting groups of conifers for winter coverts. The Michigan School of Forestry and Conservation has shown that the initial height growth of such underplantings is doubled if they are put under locust. The University of Wisconsin is comparing the attractiveness of various coniferous species. The Wisconsin Conservation Commission proposes to distribute special large stock at cost for game plantings, in the same manner as for forest plantings. Other than these three preliminary moves, I know of no attention being given this subject by foresters. It happens to be one of the few specific proposals as to game value of forests which is technically substantial and at the same time easily visualized by laymen.

In the northern part of the corn-belt, the game value of any woodlot is greatly enhanced by grapevine tangles along its periphery. Foresters in making improvement cuttings in woodlots valued principally for wild life sometimes carefully remove all such vines. This is good practice in the case of high vines on crowded interior trees, because such vines provide neither feed nor cover and injure good trees, but on the border the trees are limby anyhow, the dried grapes are the staff of life for game, and the vines are the only cover, except conifers, which remain usable in deep snow.

Corn-belt foresters have rightly focused their educational campaign on the deadly effects of grazing on woodlots forests. The specific effects of grazing on timber production are actually being measured. But would it not help to measure also the effects on game? I found to my surprise that no vegetational quadrats to determine the plant successions characteristic of various intensities of woodlot grazing have ever been laid out in the corn-belt. Such quadrats have long been under observation in the national forests.

Specifically: Errington (unpublished) finds that the quail-carrying capacity of southern Wisconsin woodlots is largely affected by the stand of beggar-ticks (*Meibomia*) and partridge pea (*Cassia chamæcrista*). These seem to disappear with summer grazing, just as Stoddard found they disappeared in Georgia. The exact measurement of the process would doubtless reveal important details, as well as clinch the proof of what now rests on mere observation and belief.

Conclusion

The long-asserted interdependence of game and forests becomes realistic and convincing only as it is differentiated into local and specific problems or rules of practice.

Failure to differentiate may lead both game and forestry into costly local fallacies, and certainly deprives both of a great volume of potential public interest and support.

In some localities the game relationship is nearly a solved problem and needs only

a little additional research to become an actual means to profitable forestry over great areas. In others, the game relationship is so complex, or so nearly unknown, that impending forestry programs will have to toss up a penny. In all cases research should obviously proceed "full steam ahead," although it is not yet doing so.

The slow differentiation of the forest-game relationship may be due in part to the separatist policy of many foresters—their refusal to become coördinate parts of state conservation departments. I do not overlook the dangers involved in such official coördination; I merely call attention to the possibility that failure to hang together is sometimes occasion to ultimately hang separately. There is no dodging the fundamental fact that timber and game, like crops and livestock, are the plant and animal products of the same land, and that thorough articulation in education, research, in governmental leadership, and in private practice, is the price of progress.

THE FROST HARDINESS OF GEOGRAPHIC STRAINS OF NORWAY PINE[1]

By C. G. BATES

Silviculturist, Lake States Forest Experiment Station

NORWAY PINE is a species which covers a comparatively narrow latitudinal range, although in its range from the northeastern coast to the Lake States and southern Canada it encounters summer temperature differences of about 10° F. (say from 56° to 66° F., for the four months, from June to September) and considerably greater differences in midwinter temperatures (say from −35° and −40° F. in the northwestern part of the range to not much below zero in the Alleghenies, these being mean annual minima). Nearly as great differences are found in winter if mean January temperatures be considered, or from 0° to 30° F.

Because of its great commercial value and its extensive use on reforestation projects, Norway pine has been chosen by the Lake States Forest Experiment Station as the first species to be subjected to a scrutinizing study of geographical, varietal, and individual differences, or in other words to a "breeding" study whose primary purpose is to determine what "seed zones" should be recognized in order to avert failures in planting due to lack of local adaptation. But because of the great uniformity of appearance and development of the species, as well as the considerations mentioned in the first paragraph above, the writer has felt some doubts as to whether outstanding differences would be likely to be developed by such a study. Therefore, to "anticipate" to some extent the results of field comparisons which were started at the same time through nursery sowings of 41 different collections of Norway pine seed, an indoor experiment was begun which it was hoped would bring out the existence of physiological differences affecting hardiness. Without going into the question of what comprises hardiness to freezing and what causes the tree to prepare itself for freezing temperatures, it may be stated as more or less obvious that differences within a species should develop according as its local forms have become adapted to long or short growing seasons, to high or low growing temperatures, and to moderately or extremely low winter temperatures.

The idea of this experiment was suggested directly by the work of Dr. R. B. Harvey on the hardiness of a great variety of woody and herbaceous plants, and the experiment was made possible by his coöperation and the use of his specially designed equipment for such studies at the University of Minnesota, this being principally in the form of refrigeration rooms which can be set at any reasonable temperature. We wish to express our gratitude for the splendid coöperation given.

[1] The essential results of the experiment here described were given in Technical Note No. 22 of the Lake States Forest Experiment Station under date of January, 1930.

On April 29, 1929, 200 pots were sown with the seed of 31 of the 41 collections of Norway pine mentioned above. There were either 5 or 10 pots for each collection, and it was hoped to develop through a growing season 3 seedlings per pot, so that all would have about the same chances for growth. However, despite precautionary measures at time of sowing, damping-off fungi became active in many of the pots, and after a couple of months there remained only 136 pots containing any seedlings, with the numbers varying from 1 to 8. Because of this serious reduction, it was decided to retain all the material available and no thinning of the seedlings was done. The variations in number per pot probably had little or no effect on later development, as the seedlings were never crowded.

The pots were kept under strong incandescent light, which was supplied for 9 hours per day. Water was applied with a sprinkler without any accurate measure, and variations between pots were balanced by frequently changing the positions of the pots on the table. The general development of the seedlings was somewhat poorer than might be expected from one season in a good nursery.

On September 23 there remained 116 pots with one or more seedlings. Twenty of these, representing different geographic groups, were at this time used in a preliminary trial to determine the critical point at which some would freeze while others would escape fatal injury. After "hardening" for one week at 36° F. (any point between 32° and 42° F. is considered to check normal growth processes and cause "hardening") they were exposed at 10.4° F. (−12° C.) for 24 hours. They were then warmed gradually and brought back to room temperatures. Within a few days all were obviously dead. The treatment had been too severe and no distinction could be drawn between lots.

On October 30 this process was repeated with 20 more pots which were frozen at 17.6° F. (−8° C.), being held at 32° F. for 8 days before and 1 day after the freezing treatment. This again was too severe for all. However, following this treatment, a few of the seedlings persisted so long as to indicate that their critical point had been approached very closely.

It was, therefore, decided to test the 72 pots of seedlings then remaining at a temperature of 20° F., preceded by 7 to 10 days[2] at 32° F., and followed by two days at that temperature, before being returned to a warm room. Before a good test was obtained, however, 31 pots were lost as a result of an ammonia leak in the refrigerator, leaving only 41 for the final, telling test at 20° F.

This temperature proved almost ideal for the purpose and for the *age and condition of the available seedlings.* It should not be supposed that the critical point would be found the same under other conditions.

This final test involved 28 of the original 31 seed lots, and a total of 149 seedlings. Table 1 shows the results of the test for each individual pot, there being given first an ocular estimate of the degree of injury as indicated 4 days after their return to a warm room, and

[2] Eight of the pots were cooled in advance of the others to determine whether any ammonia leak which had occurred previously was likely to damage the seedlings. These show lower average survival than the pots which were cooled only 7 days.

TABLE 1

SURVIVAL AFTER EXPOSURE AT 20° F.

Test of December 3-16, 1929

Group No.	Region	Mean summer temperature °F.	Seed lot and pot	Number of seedlings	Estimated injury after 4 days Per cent	Actual seedling survival after 31 days No.	Actual seedling survival after 31 days Per cent
1	Upper Peninsula, Michigan.....	60	20C	7	10	7	100
2	Northeastern Minnesota	60–61	27C	1	50	0	0
			27D	2	60	0	0
			27J	1	60	1	100
			28E	4	40	2	50
			34A	4	75	0	0
			34J	5	50	0	0
			35C	5	10	4	80
			38C	4	20	3	75
				—	—	—	—
	Group total or average[a].....			26	21	10	38
3	North and northwest Wisconsin....	61–62	12G	2	60	0	0
			12H	3	50	1	33
			14B	2	25	2	100
			46C	1	75	0	0
			47D	4	30	4	100
			47I	8	15	7	88
			48A	2	20	1	50
			48B	6	40	1	17
			49B	3	30	0	0
			49D	3	20	1	33
				—	—	—	—
	Group total or average[a].....			34	31	17	50
4	Lower Michigan	62–63	19F	2	70	0	0
			29F	4	25	1	25
			30C	4	60	0	0
			54A	3	50	0	0
			80B	7	50	0	0
			81D	3	60	0	0
			82C	2	70	0	0
			87E	6	75	0	0
				—	—	—	—
	Group total or average[a].....			31	56	1	3

[a] Weighted average in all cases, considering the seedling as the unit.

TABLE 1—*Continued*

Group No.	Region	Mean summer temperature °F.	Seed lot and pot	Number of seedlings	Estimated injury after 4 days Per cent	Actual seedling survival after 31 days No.	Actual seedling survival after 31 days Per cent
5	Central Wisconsin and Minnesota..	63–66	15B	1	70	0	0
			15D	4	80	0	0
			17A	2	50	0	0
			17G	2	60	0	0
			17H	6	75	0	0
			17I	5	80	0	0
			60A	4	40	4	100
			60B	2	75	0	0
			61A	6	50	2	33
			64C	6	60	0	0
			64F	5	90	0	0
			74B	2	50	0	0
			75G	3	60	1	33
				—	—	—	—
	Group total or average[a].....			48	66	7	15
6	New Hampshire	64–65	79I	3	40	0	0

[a] Weighted average in all cases, considering the seedling as the unit.

what may be considered a final statement of survival 27 days later. So far as group averages are concerned, these and the intermediate estimates of damage tell about the same story, but differ in detail.

The pots are grouped under six geographic regions which have, on the basis of summer temperatures, been used in another connection.[3] The serial numbers are meaningless except as identifying individual seed collections. The letters A-J which may occur after any such number represent different pots with seedlings of a common origin and are given individually because of one or two striking contrasts which occurred with seedlings of identical origin, possibly due to failure to provide exactly the same soil, moisture, etc.

[3] See Technical Note No. 19, Lake States Forest Experiment Station, September, 1929, reprinted on page 232 of the February, 1930, issue of the JOURNAL OF FORESTRY.

On examining the data, there may be noted three rather outstanding points:

1. While, as a whole, the northern lots of seedlings survived much better than those from the warmer portions of the range of Norway pine (50.7 per cent for the first three groups against 9.8 per cent for the last three), the group results are by no means correlated closely with the growing-season temperatures of the seed lots. Although this discrepancy may be due to the meagerness of the data and the large individual variations (mathematically the difference between Groups 2 and 3 is not a significant one), it appears that the northern border of Wisconsin, close to Lake Superior, produces for some unknown reason a somewhat greater degree of hardiness than the equally cool or cooler region of northeastern Minnesota. If the single sample from the Upper Peninsula of Michigan be included with Group 3, the difference

is even more marked. This characteristic of the northern Wisconsin pine is not accounted for by winter temperatures or length of growing season, for in fact the nearness of Lake Superior tends to prolong the frostless season and to modify slightly the winter temperatures. Whether there may be a humidity factor involved, it is impossible to state.

2. Somewhat similarly, Group 4 shows less hardiness than Group 5, the latter being composed almost entirely of samples taken very close to the southern limit of the Norway pine range in a diagonal line across Wisconsin and Minnesota. This is especially true of Collection No. 60, one pot of whose seedlings survived *in toto*. The collection is from Kilbourne, Wisconsin, which, except for sandstone outcrops occurring along the Wisconsin River, would apparently be outside the natural range of Norway pine. In explaining, however, the superior hardiness of Group 5 as compared with Group 4, we can at least fall back upon the seemingly logical point that that portion of Lower Michigan represented by all of the collections of Group 4, except No. 19, is accustomed to yearly minima (average) [4] not lower than −20° F., while the generally warmer ranges in Minnesota and Wisconsin go to extremes of −20° F. to −30° F. In this respect, at least, Lower Michigan resembles more closely than any other part of the Lake States the New England range of Norway pine.

3. The striking difference in behavior between two pots of seedlings of the same seed collection, notably in Lots 27 and 60, and between individual trees from the same immediate locality, namely Nos. 34 and 35, may, as already suggested, result merely from inequalities of growth in the pots (such as more organic matter in one pot than another), but is at least strongly suggestive of the possibility that some individual parents may develop the characteristic of hardiness much more than others. In the case of Collections 27 and 60, several trees of each locality were involved, and it is quite conceivable to one familiar with the vagaries of seed sampling, that the stocks of the individual pots may have, severally, favored one parent tree more than another.

In extension of the idea brought out in Paragraph 2 above, that the winter temperatures to which the geographic form is accustomed may determine, more directly than the character of its growing season, its ability to "harden" its seedlings quickly, the data have been rearranged in Table 2 on the basis of the approximate winter minima to which each set of parent trees has been subjected. About all that can be said of this classification is that it shows that two-thirds of the seedlings which survived the particular treatment given in this test were accustomed, by heredity tendency, to winter temperatures of −30° F. or lower, and all were accustomed to temperatures at least as low as −19° F. On the other hand, forming two large groups on either side of the average of all the winter temperatures used, −25.2° F., it is seen that there were 14 survivors from a total of 68 seedlings treated in the "milder-temperature group," while Table 1 shows only 8 survivors out of 82 seedlings in the three groups having the higher summer temperatures. It certainly cannot be said, then, that winter temperatures show a

[4] Atlas of American Agriculture, Part II, Section B, 1928.

higher correlation with the survival results, and this grouping does little more than to set off the seed lots from Lower Michigan in the rather distinct category which apparently is theirs (Nos. 29, 30, 80, 81, 82 and 87). Various other temperature correlations have been tried with no better results.

TABLE 2

SURVIVAL FOR VARIOUS SEED LOTS IN ORDER OF LOWEST TEMPERATURES TO WHICH ACCUSTOMED

Collection number	Average annual minimum temperature[a] °F.	Number of seedlings	Survival	
			No.	Per cent
28	—35	4	2	50
34	—35	9	0	0
35	—35	5	4	80
38	—35	4	3	75
27	—34	4	1	25
12	—30	5	1	20
14	—30	2	2	100
47	—30	12	11	92
48	—30	8	2	25
49	—30	6	1	17
74	—30	2	0	0
75	—30	3	1	33
46	—29	1	0	0
15	—27	5	0	0
64	—27	11	0	0
Sub total or average		81	28	35
17	—25	15	0	0
19	—21	2	0	0
61	—21	6	2	33
29	—20	4	1	25
30	—20	4	0	0
60	—20	6	4	67
20	—19	7	7	100
54	—18	3	0	0
79	—15	3	0	0
80	—15	7	0	0
81	—15	3	0	0
82	—15	2	0	0
87	—15	6	0	0
Average or total	—25.2	149	42	28

[a] Read as closely as possible from isotherms, Weather Bureau data in Atlas of American Agriculture, Part II, Temperature.

SUMMARY

When seedlings of Norway pine which had been grown under indoor conditions for about 7 months, being occasionally cooled to about 50° F. during the last two months of this period, were first "hardened" for about 10 days at 32° F., and then subjected to a dry-air temperature of 20° F. for 20 hours, killing of about 70 per cent of all the seedlings resulted, so that the relative "hardiness," or at least the current degree of "hardening" of the different seed lots represented, may be compared. Dr. R. B. Harvey of the University of Minnesota may be quoted as believing that such a test of identically developed stocks offers an effective means for selecting hardy strains or individuals.

In this case, seedlings whose parents grew in the northern portion of the range of Norway pine, with normal summer temperatures of 62° F. or less, survived to the extent of 51 per cent, while only 10 per cent of the seedlings whose origins were in the warmer half of the range survived. It should be pointed out, however, that the larger, and apparently more succulent seedlings from the more southern seed often do not show fatal injury immediately, and it must be admitted that there may be some advantage in this development which in part counterbalances their failure to "harden" quickly when subjected to temperatures below those suitable for growth (41-43° F.).

As represented by seed collections in this test, northern Wisconsin near Lake Superior and the Upper Peninsula of Michigan produce the most readily hardened seedlings, although these regions have not as short a growing season as northeastern Minnesota.

Seedlings from sources in the southern peninsula of Michigan showed quite gen-

erally a lack of hardiness, as did the single sample from New Hampshire. It is suggested that Lower Michigan is in a different category from most of Wisconsin and Minnesota because of much more moderate winter temperatures; that Michigan *might possibly* use New England seed with safety, and *vice versa.* While northern Minnesota seed has been used for years on the Huron National Forest and apparently with good results, the two regions having almost the same summer temperatures, it is doubtful whether the process could be reversed, that is, whether Michigan seed would prove satisfactory in northern Minnesota.

While it is not desired to attempt to extend the practical bearings of these preliminary results too far, they have indicated differences of such a nature as to practically insure that the field tests will bring out racial differences in Norway pine. It is to be hoped that the overwintering of the stock already being grown in the Cass Lake nursery may furnish additional evidence along this line. If not, special tests under somewhat more natural conditions for the development of the seedlings should be devised for the purpose.

The question is often asked—will not such differences as are here evidenced disappear in older trees? The writer believes that if there is any evidence for such a supposition, it arises solely from the "survival of the fittest"; that there may be a considerable weeding-out of the most poorly adapted seedlings in the nursery, and in the early years of field planting, so that the older trees may not be severely injured by unfavorable climatic conditions. However, that such a weeding-out may not always be thorough is too evident, in some cases, to need any discussion, and it is obvious that if it must occur at *any* stage, the use of poorly adapted seed is certain to make reforestation more expensive than would otherwise be the case.

NATURAL REPRODUCTION OF WESTERN YELLOW PINE

By W. J. SPROAT

Forest Examiner, Crater National Forest

THE NATURAL establishment of western yellow pine reproduction on the east slope of the Cascades in Oregon is dependent largely upon the cutting method used in removing the mature stand. The following observations are based on notes made by the writer in the course of reconnaissance work over thousands of acres in the Metolius, Big River, and Paulina divisions of the Deschutes National Forest and on the east side of the Crater National Forest. During the past four years, about 15,000 acres of cut-over Crater National Forest western yellow pine lands have been systematically surveyed for recording the volume of windthrown and reserved stand, density of reproduction, and conditions influencing the occurrence of subsequent reproduction.

Conditions of Stocking

Virgin Stands. Reproduction in virgin stands may be divided into two classes: first, the scattered, unevenly aged seedlings and saplings that inhabit the shaded portions of the stand; second, the massed, evenly aged groups that occur in small openings. These openings are usually less than a half acre in extent and are generally caused by the death of a mature of overmature tree.

A large percentage of the first class show slow growth and poor form and are not good material for future stands. Logging destroys many of these, and many die from natural causes soon after the protection of the overwood is removed. The seedlings in the second class are ultimately represented, through the survival of the fittest, by only one or two mature trees.

Immature Stands. Good stocking of evenly aged young western yellow pine timber, called "bull pine," rarely occurs in this region. Patches were mapped on Cache Creek, Deschutes National Forest, and on Four Mile and Fourbit Creeks, Crater National Forest. Favorable conditions occurring in exceptional sequence influence the development of these stands, as they are uncommon and do not occupy large areas.

Cut-over Areas. Approximately 80 per cent of the total volume of merchantable western yellow pine on 18,000 acres of Crater National Forest lands has been logged off. Subsequent reproduction occupies about 1 per cent of this area. The reserve stand averages about 3000 board feet per acre.

Several examinations on widely separated areas have been made in virgin stands at the edge of cut-over lands for the purpose of recording comparative occurrences of seedlings. In all cases, small unevenly aged seedlings occurred only in the virgin stands. In the report on the experiment on grazing management of cut-over lands, where data were collected during 1925 and 1926 before and

after cutting on the Owen Oregon sales area, Fourbit Creek, Crater National Forest, it is recorded that 20 per cent of the seedlings under 2 feet in height died from natural causes during the first year after the removal of the virgin stand.

Openings in Stands. Natural encroachment of seedlings on burned, windthrown, or clear-cut areas covering three acres or more is generally very slow. Good stocking of saplings rarely occurs in large openings. No areas have been found where good stocking of seedlings occurs on open sites that cover more than an acre or two.

Observations on Germination and Survival

Soil Disturbance. Observance of the growth of seedlings in tractor and auto-truck roads, and on logging railroad spurs, furnishes data which aid in learning nature's ways of establishing and perpetuating this species. Soil disturbance on lands adjacent to the logging-railway spur and the auto-truck hauling roads in Sections 24 and 25, T. 36 S., R. 6 E., W. M., Crater National Forest, was exceptionally light as only about 50 per cent of the stand was removed. This cutting took place in 1910 and 1916, but the hauling routes were not entirely abandoned until 1920.

The absence of seedlings in the old hauling routes where soil had been packed or thrown loosely to the side is in marked contrast with the large numbers of seedlings and saplings of all ages that are growing on the adjacent lightly cut areas where railroad spurs had existed for a year or more prior to the removal of the bordering virgin stands. This removal occurred on Crater National Forest sale areas; since then a large number of seedlings have started to grow. In one case the grading had been completed, but the ties had not been laid and practically no litter, grass, or herbaceous growth had appeared on the prepared mineral surface. The seed was more exposed here to birds and rodents than elsewhere; but much of it escaped molestation since large numbers of seedlings became established. Soon after the bordering protection is removed, the seedlings usually die from exposure. Those started on mineral soil do not resist exposure so well as those which have been established on undisturbed soils.

Brush Cover. Brush cover in this region is made up of intolerant species, largely *Manzanita, Ceanothus velutinus,* and *Kunzia.* Good stocking of seedlings does not occur beneath the thick masses of brush that are common in many of the openings on the Crater National Forest.

Squaw Carpet. Western yellow pine seedlings of all ages have been found growing in squaw carpet (*Ceanothus prostratus*) beneath virgin stands and on a lightly cut area. This tolerant evergreen shrub, which forms a thick mat or carpet, is common in practically all of the western yellow pine type on the east slope of the Cascades in Oregon. It occurs on all the cut-over lands of Klamath Lake and Fourbit Creek areas on the Crater National Forest, but is in smaller patches in the open stands and does not show the thrifty, dark-green foliage found beneath virgin timber stands. Western yellow pine seeds have been found by tearing the mats free from the ground and sifting the thick

layers of humus particles that accumulate between the mass of shallow roots and the short stems of this shrub. Where cones had landed on squaw carpet, a number of seeds had evidently been spilled in one spot, as it is common to find a dozen or more spindly seedlings growing from a space no larger than a square inch.

Unburned Slash. No subsequent reproduction has occurred on old sale areas where scattered débris had not been cleaned up. Heavy layers of needles no doubt prevent germination. No seedlings have been found in or near the unlopped tops of old wind-thrown trees, which are found scattered over practically all the cut-over lands.

Burns and Burned Spots. The blackened spots on the sale areas caused by the burning of the slash piles remain barren. No reproduction of shrubs, grass, or herbs has occurred for more than 20 years. Planting of seedlings in these spots has not been undertaken. The establishing of western yellow pine by planting in the ashes of a severe Douglas fir burn on a south exposure on the west side of the Cascades, Crater National Forest, has been successful. The compact, thick layer of ashes and soil on the spots where slash piles have been burned may furnish sufficient protection to the roots of planted nursery grown seedlings to enable them to withstand the rapid drying that occurs in the adjacent loose sandy soils.

Exceptionally Stocked Areas

Examination of the cut-over lands on the Crater National Forest has revealed two or three small scattered areas totaling less than five acres where excellent subsequent reproduction has occurred, and one area of approximately 300 acres that is exceptionally well stocked with seedling and sapling growth.

Approximately 50 per cent of the merchantable timber from this latter area was removed in two cuttings: the first in 1910, and the second in 1913 when only occasional decadent trees were removed. The reserved trees are evenly distributed and many of these would have been cut under the marking practice that has since been adopted. This tract is surrounded by western yellow pine lands from which a much larger percentage of the merchantable volume has been removed. Many areas on all sides of it were cleared of trees by a severe wind that occurred in the spring of 1920.

Table 1 shows the number of western yellow pine seedlings per acre by age classes in different types of ground cover on the exceptionally stocked area. The figures represent the average of 20 plots each one chain square, situated five chains apart on the middle of the north and south halves of forties numbered fourteen and three in sections 24 and 25 respectively in T. 36 S., R. 6 E., W. M., Crater National Forest.

Conclusions

1. About 1 per cent of the total area cut over on the Crater National Forest has subsequent reproduction.

2. Western yellow pine seedlings require protection through reservation of a certain percentage of the mature stand.

3. Soil disturbance is not always an aid to permanent establishment of seed-

TABLE 1

BY AGE CLASS AND GROUND COVER ON AN EXCEPTIONALLY STOCKED AREA

Ground cover	Age, years																All ages
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	
Squaw Carpet	3.5	23.5	21.5	17	23	20	20.5	14	12	18	5.5	15.5	11	9.5	10	13	237.5
Squaw Carpet and Brush		2.5	5	6.5	4	9.5	3	5	3.5	3.5	2.5	8.5	8.5	10.5	6	7	85.5
Brush		3	6.5	7	3	4.5	4	5	1.5	2	1	3.5	4.5	8	4.5	1.5	59.5
Barren	.5	.5	1.5	5	2	5.5	9	2.5	2.5	2.5	1.5	5.5	2.5	5	4	5.5	55.5
Total	4.0	29.5	34.5	35.5	32	39.5	36.5	26.5	19.5	26.0	10.5	33.0	26.5	33.0	24.5	27.0	438.0

lings, but may cause an increase in germination under favorable conditions.

4. Many seedlings and saplings that are destroyed or injured in the process of logging the mature timber would not have made good timber.

5. A large percentage of the seedlings and saplings that escape injury or death from the logging of the mature stand die from exposure.

6. Squaw carpet aids in protecting the seed from being eaten by rodents and birds, and regulates temperature and light to the advantage of germination and survival of western yellow pine reproduction.

SILVICULTURE AND UTILIZATION

By CHARLES LATHROP PACK
Lakewood, New Jersey

SOMETIME ago I sent letters to one hundred foresters with whom I have long been in active correspondence. I wanted to learn what they were thinking about the many phases of forest utilization and the relationship between silviculture and wood use. My purpose was not to solve a problem. I wanted to find out how foresters were dealing with this complex question, and to what extent they felt that silviculture and utilization might be more closely integrated.

The replies delighted me. From coast to coast they represent such varied points of view that in cross-section they present a forum of opinion on the whole problem. Their thought has an additional interest in connection with the educational inquiry, since many of these letters are from forest educators, and tell what is being done in the forest schools to bring about a closer tie-up between wood production and wood use.

As was to be expected, the letters were in practical agreement regarding the responsibilities of the forester in practicing silviculture. The nature and purposes of silviculture were clearly held and clearly expressed.

But when they touched on the subject of utilization, the picture had radically changed. To some, utilization meant slash disposal, either for the purpose of creating favorable conditions for new stands of timber or for decreasing fire hazard. To others utilization meant a disposal of the products of thinnings—a means of benefiting the growing forest. To still others utilization was the elimination of sawmill waste or the use of species now regarded as valueless. But from not a few of those letters I got the viewpoint that utilization is even more. These letters pictured it as the governing factor which must ultimately dictate the kind of forests we grow and with which silviculture must shape itself to meet industrial demands.

It was natural, of course, that to different foresters utilization should mean different things, since each in his own particular region is confronted with a different aspect of utilization. In the Lake States utilization centers about solving the weed tree problem, decreasing the amount of material left in the woods, building up markets for low-grade products, and creating markets for new products. Good roads there have extended the use of coal and the market for cordwood has suffered, cutting down one of the best outlets for low-grade materials.

Throughout the Middle West utilization centers about the farm woodlands, where it becomes a question of marketing forest products. In Iowa, for example, the most difficult forest problems are not silvicultural but have to do with marketing—especially coöperative marketing. Foresters there and in other agricultural states are finding it no easy task to induce farmers to plant because of the difficulty in marketing timber that already exists.

As one state forester puts it, "Silviculture cannot go faster than market conditions warrant."

This difficulty of obtaining markets for the wide range of species and grades of material that a forest produces is common to New England, the Central Atlantic States, and the South. Maine has its problem of marketing hardwoods. She is faced with an abundant supply but very limited markets. Here, too, the problem of utilization is linked up closely with silviculture, since the success of foresters in changing the next crop to spruce is going to depend on their ability to eliminate hardwoods from reproduction. The back-hill towns of New Hampshire, in cut-over territory, contain timber of low average value, available for many industries which have long since gone out of business. To build up these industries has become the important utilization problem.

Florida and Georgia are emphasizing the need for creating markets. Pennsylvania is hunting markets for the products of thinnings from farmers' woodlots, and developing markets for all low-grade products. All this, of course, points to the importance of securing more complete utilization from the standpoint of practicing silviculture. In New England silviculture is marking time because of the check to marketing. One state forester in that region writes that his state woodlands can be put under management in a practical way only where varied and ready markets exist. He tells of a forester who recently took charge of a timber tract for a group of land-owners. The forester soon found that his properties had large volumes of box-board lumber and poorer grades of wood which good silviculture demanded should be cut, but which were without markets. His problem had become a utilization problem. Both he and the owners of the tract are now striving to help finance the needed industries and to encourage outside industries to come into the territory.

On the West Coast, where saw and axe are busier than ever before, utilization problems center about decreasing the margin of loss in low grade timber and waste material. In California both silviculture and fire protection are suffering from incomplete utilization. According to one forest educator in that region, "We know little enough about the proper forestry practice to produce trees quickly and cheaply; we know still less about what the future holds in the way of markets or demand for forest products." Incomplete utilization there is not only a drastic deterrent to silviculture, but has become the cause of high fire hazards.

To my mind, one of the most interesting results of these letters is the way in which they bring out the consensus of opinion that effective silviculture is in the long run dependent on utilization. Utilization is the neck of the bottle through which all silviculture must ultimately pass. Yet it was not so very many years ago that utilization was not considered quite so thoughtfully, nor did it appear so prominently in forestry discussions. One of the earliest foresters in America was accustomed to say, "A forester is through with a tree when he has grown it, ready to cut. He then has no further interest in the matter."

We have come a long way from that point of view, but perhaps we have not come far enough—at least that is the thought embodied in many letters. For these were constructive letters and, not

content with pointing out the intimate relationship between silviculture and utilization, they went on to suggest necessary steps that must be taken to draw them closer together. Forest schools, especially, are thinking in terms of closer integration between silviculture and utilization. One educator suggests that forest schools study phases of utilization in the regions where they are located, and by correlating these studies assist in developing silvicultural practices which might apply to the needs of these forest regions. A professor in a state college of forestry writes that there is a woeful lack of information on the time it takes to grow certain forest products and the possible market for utilization of the products. One of the great forest educators of the East has already undertaken two attempts to clarify the market situation, with studies on woodworking industries and on the marketing of lumber.

The main purpose of the Pennsylvania Forest Research Institute is close coordination of silviculture and utilization. In one of the southern states, educators are emphasizing the importance of utilization in all management plans for vocational school forests. Accurate records are being kept there of the value of each product marketed, as well as the new markets which may be found for any individual product or by-product of forestry. One state forester believes that the development of utilization information and a sales policy to encourage the public to use material made from thinning operations are as necessary as the thinning operations themselves in growing pine forests. Another holds that if they could solve the so-called " weed tree " problem, silviculture would automatically take care of itself. In the Lake States, educators are considering developing markets for new products, especially those produced by chemical means.

In all these letters it is the emphasis rather than the thought itself that is new. And this new emphasis that foresters are placing on utilization as an integral part of silviculture has been brought about by rapidly changing conditions, part of which may be the tremendous possibilities that the chemical production of cellulose is holding out to forest industries. The dean of a western forest school writes, " Perhaps the forester of the future will not be so much concerned with the production of boards as with the growth of wood material that can most readily and profitably be converted to pulp." In one section of Maine, at least, no system of silviculture is considered that is not primarily for the purpose of producing merchantable pulpwood material in the shortest possible time and at the least expense.

" Silviculture," as one educator in forestry points out, " no matter how highly developed and theoretically perfect, will never solve the forest problem unless the marketing angle is put on a practical basis." One of the most prominent of American foresters adds, " Silviculture cannot be practiced without close attention to utilization. It is only where utilization has been developed to a reasonably high degree that silviculture can be practiced at all. Anyone managing a forest must manage it as any other successful business. It must be managed to make a profit or go out of business. This means that the silviculture you apply must be controlled by what comes out of the forest in the way of products." That sentence, I think, deserves emphasis. It is one thing to look upon utilization as an

aid to silviculture and fire protection and as the consumer of whatever products the forester elects to grow. But beyond that, this forester is looking upon utilization as the great molder and modifier of silviculture—as the force which determines silvicultural practice and purpose, since it alone gives to silviculture its right to exist.

That as foresters we have not given enough attention to utilization would seem the conclusion of several letters. "Since," they point out, "the uses to which wood can be put must modify and control both the degree and aim of silviculture, it is as important to analyze and forecast these uses as it is to apply scientifically correct silviculture to the raw material." One writer, long experienced in forest problems in the West, believes that among many foresters "silviculture has become a religion, which at all costs should not be desecrated by any economic consideration." His own view is that "silviculture is merely one of the important means of reaching economic ends." It is not an end in itself. The great purpose of forestry is to carry out certain economic aims. An educator writes, "It is not that silviculture should be given less stress than it has received in the past, but that utilization should be given more. Forestry and sound economics must go hand in hand."

Emphasis, too, is laid upon the important consideration that the growing of trees is a long, complex process. During the lifetime of a forest utilization demands and market conditions may radically change. The failure of the farmer to forecast his markets is obliterated by the coming winter—the mistake of the forester endures for generations. Future demands cannot always be forecasted. The weed tree of today may be the valued product of tomorrow. The species we hopefully plant today may, in the light of the next fifty years, prove of small value. And all this, while frankly acknowledging the tremendous difficulty of the problem, as many of my correspondents point out, makes the responsibility of the forester all the greater to examine carefully every straw which may tell in what direction the industrial wind is blowing, and will blow during the maturity of his crop.

Perhaps the heart of the matter can be no better expressed than in the words of one whose name stands among the highest in forestry. He writes: "The main trouble with the forestry profession today is that most of the men have been engaged in problems of forest production, and have had no opportunities to take part in the actual disposal of the products. One difficulty with the forest schools is that the students have not come in direct contact with the marketing end. In spite of the instructional work in logging woods and at the mill, it is difficult to get across to the student the financial aspects of forest utilization."

The letters have left with me the knowledge that the forestry profession realizes more clearly than ever before that silviculture and utilization are not two phases of forestry that can be kept each in a hermetically sealed compartment. They are, instead, two important parts of a single economic whole. They interact. Better silviculture brings the goal of complete utilization closer. Better utilization makes possible better silviculture, and is a greater incentive to silviculture. It is utilization that makes silviculture purposeful. So the whole trend would be to

regard tree growth and tree use as essentially a continuous part of the same operation.

And let me repeat that in all this I have aspired to no attempt at solving a problem. But I do believe it well worth while to present to the profession a résumé of the best thought of our leading foresters on a fundamental and increasingly important subject.

THE STATUS OF INDUSTRIAL FORESTRY IN CALIFORNIA[1]

By EMANUEL FRITZ
Division of Forestry, University of California

MUCH has already been accomplished in the way of private or industrial forestry in California. However, it can be looked at from both a pessimistic viewpoint and from one of extreme optimism. The pessimist is not satisfied that the private forestry endeavors are genuine and sincere, and he is inclined to belittle them because they are still so far from his ideal. The optimist, on the other hand, fails to weigh the efforts and results sufficiently and is inclined to lean back and feel that "all is well." Both pessimist and optimist can find considerable evidence to prove their contentions. Rather than give statistics or references to the efforts of individual companies which the one class could use as dynamite and the other as cold cream, I will limit myself to generalizations.

It would be improper at this early stage to take the private forestry clock apart to see what makes it tick. It is better to let it tick on and see first if it is going to keep time. Private efforts are admittedly still feeble, and to some extent faulty. But let us not be too impatient. Remember that Rome was not built in a day and that our own forestry profession, though already thirty years old, is still in the groping stage. Feeble as the private efforts are they loom very big and important indeed when compared to those of only a few years ago, and in view of the fact that the industry has made this progress in the face of a century of self-sufficiency, dulling tradition, obstinate resistance to change, and a lack of faith in its own future. When one considers also how little practical knowledge of American forestry we technicians have been able to offer the private owner, we should not have expected much greater progress in the past. I am as impatient to see more private forestry as some of you are, but I am inclined to feel that, considering everything, the present progress is satisfactory. I look for it to continue at an increasingly rapid rate and I think also that it may eventually find some of us trailing behind.

This year there are additional pine operators who are leaving their cut-over lands in much better condition through lighter cutting and less destruction of young growth. The increased use of tractors in the pine region is responsible for much of this improvement. The tractor was introduced primarily to lower logging costs but it has become incidentally a forestry ally of unexpected but real value and importance. There is

[1] Presented at the annual meeting of the California Section, Society of American Foresters, San Francisco, Dec. 17, 1929.

This paper is based upon reports made by the author to the Society of American Foresters in 1926, 1928, and 1929, as a member of its Committee on Industrial Forestry.

added interest in selective logging in both the pine and redwood regions, though the actual accomplishment is yet small.

Studies are being conducted on private operations in the pine and redwood regions by the U. S. Forest Service, the Division of Forestry of the University of California and the owners themselves to determine the feasibility of private forestry. It is expected that these studies will materially influence for the better both logging and utilization methods and the owners' attitude toward managing their lands for permanent income. Progress may be noted also in the pine region in an improved fire consciousness and more satisfactory coöperation in fire protection between the U. S. Forest Service, the state forestry department, and the private timber owners.

On the part of the public, I can report enlarged interest in forestry and lumbering. It has given the lumber industry of California a splendid reforestation law, but much yet remains to be done to give the layman an intelligent understanding of the problems confronting private forestry endeavors. The public has yet to learn that profitable forestry depends upon the continued use of forest products in large amounts; that forestry must pay before it can become a commercial success; and that it must bear its share of the burden of forest protection and must respect the lumberman's property as it expects him to recognize his own obligations.

Were it not for the continued depression in the lumber industry, I believe I could report even greater progress in private forestry. This depression has serious aspects for forestry. It deprives the lumberman of spare capital to put into extra activities and it puts him into a depressed frame of mind. Sales have been satisfactory as to volume, but the returns are below what the investment and the hazards warrant. Without question, the lack of a buoyant spirit and spare funds has militated against some private experimentation and investment in forestry. In the redwood region, the depression, combined with the unsatisfactory results so far obtained from planting, has caused a marked shrinkage in the reforestation programs, though this is offset somewhat by developments that promise better results than did the planting. As one pine operator put it to me, " It is difficult to become excited about growing a future supply of wood products when it is increasingly difficult to dispose of the present supplies."

Whole-hearted and active interest in private forestry (a subject still not well understood by most operators and still clouded with too much theory) cannot be expected while the lumber industry remains less profitable than other industries, and until foresters themselves quit harrying private owners and exhibit a better understanding of the industry's problems and peculiar characteristics. Furthermore the continued stirring-up of animosities through the publication of such ill-timed and one-sided reports as Major Ahern's " Deforested America," simply engenders doubt of our common sense and suspicion of our motives and keeps foresters and lumbermen in two separate camps. Such a report might keep lumbermen alive to the public interest in destructive lumbering, but at the same time its destructive criticism does not encourage their interest in forestry. It is therefore inimical to respect for our profession. In spite of the dis-

couragements and the general gloomy outlook for the lumber industry there has been distinct progress in private forestry and those lumbermen who have had the courage to contribute deserve our commendation.

Let me now discuss some specific items more thoroughly.

General Purpose of Management

What is the general purpose of management of private timber owners? In nearly every case in California, the principal purpose of the owners is to convert the virgin timber into lumber as rapidly as possible. This is quite natural and should be expected. It is the object for which the timber was acquired and for which the operating companies were organized. In recent years, however, several companies have added an additional "purpose"—that of keeping the present or a modified mill in logs perpetually. I think this is one of the most promising developments and I have no doubt that the example set by the few will be followed by others. Those who have announced a continuous production policy have done so with full realization that future annual cuts might be measurably smaller than the present. There is also a realization that the product of second-growth timber will introduce very different problems of logging, milling, and marketing.

Progress in Fire Control

What progress has been made in fire control? Here we must make a clean distinction between our pine and our redwood region. The problems and practices differ widely.

Pine Region. In the pine region there is a very general and sincere effort on the part of most operators to keep fires out of their cut-over lands and virgin timber. In this region fire is especially destructive and the hazard is great; a fire may cause the extinction of tree growth from large areas for many years, and the salvage of fire-killed timber is low. Only a minority of operators is still disinterested and careless or hostile to the protection policies of the federal and state forestry agencies. Locally, there is still honest belief in so-called "light burning," although the understanding of the rôle of fire is improving. At present all the principal operators and holding companies coöperate with the U. S. Forest Service in protection matters. Some of them maintain, in addition, their own protection departments, while others rely wholly upon the Forest Service to whom they have virtually contracted the protection job.

The protection effort is now greater and more successful than ever before but it is still deplorably inadequate. It is comparable to a metropolitan city trusting its protection to a village fire department. The lack of more adequate fire protection gives many owners a legitimate explanation for not practising forestry. One pine operator informs me that, "The fire menace offers considerable discouragement to private owners in making any considerable investment in timber growing. Even with the best of vigilance, fires do get started and they make the operator wish that his lands were clean burned. Perhaps the work of fire protection of cut-over lands should be made more an obligation of the public. It is the public that is probably most interested in their protection." Another writes: "I feel certain that there is such a thing as complete protection from fire, but I am not

sure that such protection can be secured in the California pine region at a cost that would make private forestry very attractive." The author of this statement was thinking of the protection burden being carried solely by the owners. My own opinion is that the public should shoulder the largest portion of the burden, just as it does in city fire protection. Forest protection will never be effective if left to the vagaries and varying practices and standards of neighboring owners alone.

Redwood Region. In the redwood region fires have been so long considered a necessity or a proper thing that they have become a tradition and are looked upon with complacency. There is no general fire consciousness in the redwood region. The present year has been one of the worst of record. The first rains of the reason did not fall until December was well started; for over two months in some sections the atmosphere was charged with smoke; much damage was done to young forests and to old growth; serious damage was done to grazing lands and woodlands adjoining redwood forests; tourist traffic on the Redwood Highway fell off; and many visitors expressed indignation over the wreckage of advertised beauty. Apathy toward fire was general and incendiarism was rampant. Even those timber owners who went on record earlier as being in favor of complete protection made only feeble effort to control fires on their lands. Fires, this year, burned into redwood timber that had not been visited by fire for perhaps 200 years. The state legislature made a grave mistake when, a few years ago, it exempted the redwood region from certain provisions of its fire protection laws.

The fire hazard in the redwood region is not as high as it is in the pine region; fires are relatively easy to control, and damage is not so great. Usually the weather is unfavorable to the rapid spread of flames, but when the occasional emergencies do come they find the local agencies unprepared to meet them. Furthermore the very general but unfounded belief that fire cannot hurt the redwoods, and that fires are a good thing for the old growth, causes action to be delayed until it is almost too late. Nevertheless, there is a place for fire in the redwood belt. The slash and débris resulting from logging are so enormous as to impede logging and increase its danger. It has been and still is the custom to set fire to a newly felled area as soon as the trees are down and peeled but before they are made into logs and only when the possibility of a good hot burn is evident. These slash fires leave the trunks bare, though more or less charred, while most of the refuse that hides the logs is consumed.

Such fires do a great deal of damage to the down timber, and frequently run into the green standing timber, wiping out not only underbrush but young growth as well, and burning out the bases of many large trees sufficiently to make them fall. It is safe to say that practically all the butt rot in redwood had its origin in a fire scar. Slash fires may be called controlled fires, but the men in charge as well as their superiors generally feel that no harm is done if they run into uncut timber, and they therefore do not exercise proper control to keep them in bounds. Small operators making split products—ties, posts, shakes, and stakes—are troublesome during the fire season. Their débris is par-

ticularly heavy and inflammable and they are all too prone to set a fire to clean up the mess and let it burn at will.

Fires have already taken their toll of forest plantations, and some valuable experimental plots have been wiped out. State rangers and company employees do a lot of hard fire fighting in the region, but they are too few and a portion of the public is all too ready to defeat their efforts. Foresters who have grappled with "light burning" in the pine region do not know what it is until they have seen it in the redwoods. The rôle of fire in the redwood region, past and present, deserves intensive study. My own opinion, based on nearly ten years of observation, is that fires have no place in the redwoods unless used to consume slash or to clear land under adequate control and by methods less destructive to unmerchantable trees than the present.

It is my opinion that more adequate fire protection is of paramount importance in encouraging further private forestry effort, and that the public must bear a large share of the burden of prevention and suppression or do without forests.

Slash Disposal

In the pine region more operators are piling and burning their slash or are otherwise fireproofing their cut-over lands. Small operators, however, still present a difficult problem and cause concern to adjoining property owners. They are the least willing to fireproof their lands and are the poorest coöperators. In the redwood region slash is left where it falls and is burned broadcast. The traditional method of doing this has already been described. Some companies are trying improved methods and have reported that they plan to keep fires out of their slash until after logging is completed. Slash disposal in the pine region has been pretty well worked out. In the redwood region it is still an all-important obstacle to forestry practice and an unsolved problem.

Methods of Cutting

In both the forest regions of California one has the choice, under present conditions, of two main systems of logging; one is destructive stripping and the other is conservative selective logging. In the pine region the Forest Service cutting methods are a guide for private owners and modification is doubtless necessary before these can be applied to private lands. Lumbermen of the pine region are increasingly interested in adopting some form of selective logging and good progress can be reported for them for the past year. More experimental work is necessary, however, before foresters can give convincing proof that the extra cost of selective logging in the pine region will eventually come back to the operator. The method is a splendid success under federal conditions; doubtless it holds hidden values for private owners that need to be made more clear.

In the redwood region there is no precedent to guide selective logging proposals as there is in the pine region. In the past two years, however, there has been a very rapid growth of interest in the possibilities of such a method. In the redwoods, more than in the pine country, selective logging is ideally possible from a silvicultural standpoint. Practically, however, there are some seemingly insurmountable obstacles, such as heavy slash, stand density, great tree size, difficulty of

felling without smashing small trees, and present yarding methods. Selective logging in the redwood region, if practised in the same manner as on government-owned pine lands, would bring results surpassing anything any forester ever dreamed possible.

But is selective logging in the redwoods possible; if so, to what extent? If it is desirable, can it be introduced under present conditions of logging? I am certain that it cannot. To attempt selective logging in the redwoods without revolutionizing present logging methods would have only one result—a greater waste of timber and more loss to the owners. I have given the possibilities of selective logging in the redwoods a great deal of thought and study, and while I am thoroughly convinced of its desirability and its silvicultural feasibility, I cannot see how a redwood owner can practise it without a complete change of present logging methods and standards. Such changes should be given early study.

As soon as a feasible scheme is worked out, the further clear cutting, or what is more descriptive, the wrecking and salvaging, of redwood timber can be characterized as wanton destruction. Until then, it is "just too bad." You would be surprised at the rather general interest and effort toward changing present logging methods. The past two years have seen several fundamental changes or trials at change that are important preliminaries to working out a scheme of selective logging. The future of the redwood region lies in selective logging. I am convinced that the present clear cutting followed by planting is not the way to handle virgin redwood lands for future crops.

Before I go on to the next subject, let me offer a caution about selective logging. What is it, selective utilization or a selective system of silviculture? The name does not suggest the latter. Any scheme of selective logging that does not include a silvicultural aspect, that is, the protection for future growth of unused trees, is nothing more than a method of more wasteful logging. Let us decide early what we mean by selective logging.

Reforestation

In the pine region planting is not necessary except on lands that have been badly skinned or burned. Under selective logging reforestation is taken care of automatically. Even ordinary logging, where it is not too close and where fire protection is good, is being followed with good reproduction. However, several companies are experimenting with planting on old burns or previously skinned lands. Planting is not an attractive undertaking for a private owner in the pine region.

In the redwood region planting has received much attention, and there are two large privately owned reforestation nurseries. For reasons already mentioned the planting programs have been greatly curtailed. In Humboldt County, planting has decreased from close to 5000 acres in 1926 to programs totaling less than 1400 acres. In Mendocino County the planting programs have decreased from over 3000 acres to approximately 1000 acres. There is good reason to doubt the efficacy of planting and the attainment of the yields predicted from the study of naturally reproduced stands. Under selective logging it would not be necessary.

Sustained Yield Management

Very encouraging progress can be reported in the amount of interest shown

and thought being given by private owners to the possibility of sustained yield management. Not all private forest properties are so situated, or have enough uncut timber in sight, or have sufficiently favorable growing conditions, to make sustained yield a possibility. There is really insufficient data upon which a company could base a plan of sustained yield management. Many operators feel that the future of lumber is too insecure and the possibility of and market for cellulose too unknown or too easily overdone to make sustained yield a good investment.

In spite of this, however, some operators are convinced that it is worth while to hold on to their cut-over lands for whatever they will produce naturally. Several companies have committed themselves to such a basis of management, and no matter what the motive, it is certain that the idea will take firmer hold as its benefits are further appreciated. Those operators who have embarked on the sea of sustained yield management deserve our hearty commendation. They have started out on an uncharted course and no one can tell them where they will land, or if they will make port at all. In this respect I think it is of utmost importance that foresters accept the doctrine that private forestry must pay, and that to make it pay we must help to keep wood in favor as a building material or else seek outlets in the unknown and speculative fields of cellulose. The private operator must be assured a market for his product before private forestry will attract him.

As a final contribution let me offer a thought which at the same time is also a charge to foresters. As a profession we are thirty years old, although forestry propaganda is much older. In that time we have developed the splendid federal Forest Service, many state forestry departments, and many good forestry schools; our forestry knowledge is increasing and it is less crude; and we have developed progressive and far-reaching legislation. But we have not made comparable progress in private or industrial forestry. We have been altruists and crusaders, but we have met a Saladin who has brought us to our senses.

Is it not time to investigate our gospel and find out why it does not work in all quarters? Is it not possible that we have overlooked something ourselves, perhaps economics? If our forestry gospel is sound, why have we not made more converts among lumbermen? The lumber industry is very large, and despite its peculiar individualism, inertia, and slavery to tradition, there are in it many high-grade business men who are as good as any we find in other industries. Have they found holes in our theory or do they not like our methods?

I feel, therefore, that there might be something wrong with the gospel or with its disciples. Are we preaching a theoretical gospel or a practical one, or are we just poor preachers? Are our wares no good or are we just poor salesmen? Is forestry an altruistic occupation, " an emotion," or is it an industrial enterprise? Let us not cease our efforts to develop private forestry but let us at the same time check up on our theory and its basis and upon our methods. And above all let us be optimistic and encouraging rather than pessimistic and condemnatory.

Summary and Conclusions

1. Private forestry in California is progressing, though not rapidly. Cut-

over lands are being left in better condition in the pine country.

2. There has been much progress in fire protection in the pine region. In the redwood region there is no fire consciousness, a general ignorance of the rôle of fire, and insufficient state fire legislation. There exists in the redwood region almost no conception of the true relation of fires to the future of the forest and to tourist traffic.

3. The depression in the lumber industry has serious aspects for private forestry. A sick industry has little faith in its future and no interest in assuming additional burdens.

4. The continued growth of the forestry profession will have to be in industrial forestry. This field needs cultivation.

5. The obstacles to the practice of industrial forestry must be lessened before private capital can become deeply interested.

6. The lumber industry must be assured that markets for wood or other forest products will not be wiped out. The large scale loss of market for wood products is a blow to forest growing.

7. The much-talked-of possibilities in forest use for cellulose instead of for lumber are not based upon sufficient experience and data to warrant them; and if they exist there is grave possibility of cellulose markets being easily and quickly overdone.

8. Better fire protection, in which the public must assume a larger share, is of paramount importance in the inauguration of greater private forestry effort.

9. Planting is unnecessary in both the pine and redwood regions if logging is on a selective basis and advance growth and uncut trees are protected during logging and thereafter.

10. Selective logging on some private lands in the pine region appears to be a good venture. More data is needed to indicate its further extension.

11. Selective logging in the redwood region is gaining a hearing. It is a new thing in that region, but the redwood forest is admirably adapted to its application from a silvicultural standpoint. From a practical standpoint there are what at first appear to be insurmountable obstacles which the author believes can be overcome through study and experimentation. The future of redwood forestry is in selective logging, not in planting.

12. Sustained yield management is not possible for all operators. On the other hand those lumbermen who have large bodies of timber on good growing sites have not gone as far as they should in investigating its feasibility and possible benefits. A re-blocking and merging of timber properties, and the temporary suspension of operations on poorly financed or poorly located properties through acquisition by the United States or by stronger companies, would make sustained yield management feasible on a large scale and possibly a real attraction to the owners.

13. The public has not a sufficiently clear notion of what forestry is, and it does not connect logging with forestry.

14. We have advocated forestry a long time but have not checked up sufficiently on the practicability of our theory. Foresters must be better equipped with facts pertaining to the possibility of forestry as a private enterprise.

15. Foresters must learn that forestry is not a cause, an emotion, or simply a pleasant occupation, and that private forestry is a cold-blooded business enterprise.

LOG UTILIZATION

By BURNETT SANFORD

Formerly with Sugar Pine Lumber Company, California

THE question of the proper utilization of the tree is one that has been discussed by foresters for many years, but to my knowledge has never been fully analyzed. In preparation for the predicted timber shortage we have advocated more complete utilization without considering the fact that today's material loss may far outweigh the value of an extension of the life of the present virgin timber supply.

In considering this problem we are dealing with three factors: material, labor, and capital. The waste of any one of the three is an economic loss, and to compare the relative value of the losses they must be reduced to some common factor, which for convenience will be the dollar.

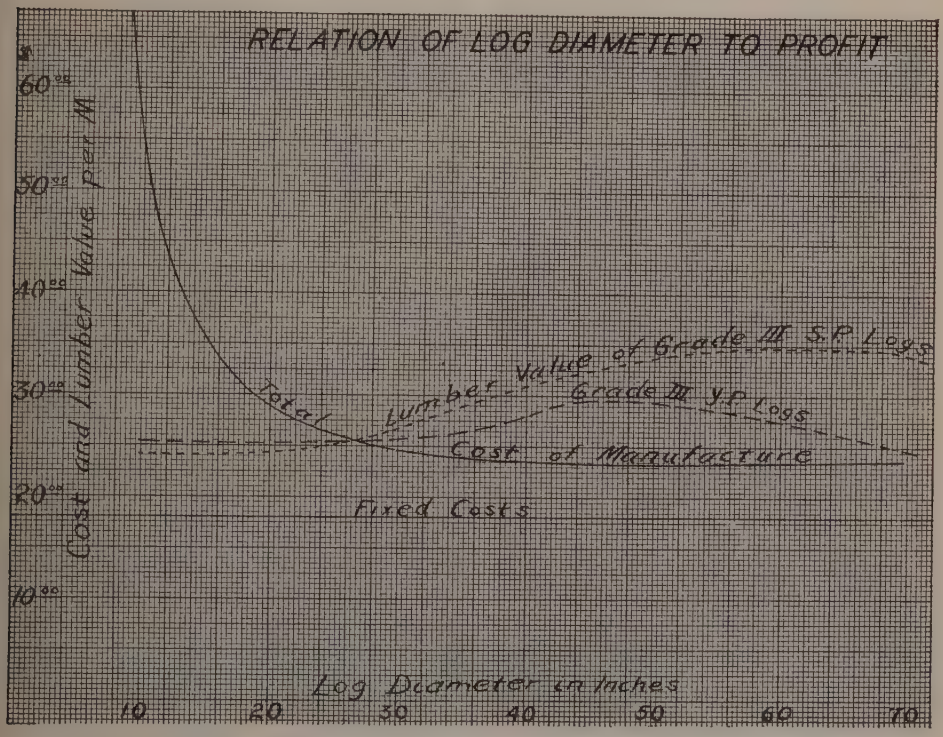

FIG. 1.—Relation of log diameter to cost of manufacture and lumber value.

Figure 1 has been worked up from data obtained on a large lumbering operation in the California pine region,

cutting both private and government timber. A complete analysis was made of this operation by competent foresters and I am using it as an illustration of a common practice in the region. The results of this particular study are probably not applicable to any other operation but the principles apply in a degree to all. The graph shows the total cost of production for 1928 for logs of different sizes, from the stump, through the mill, and on to the car. The value curves show the value of the product obtained from logs of different sizes based upon Forest Service mill-scale studies with the 1928 average selling prices applied. Since all of the figures used are based upon averages the values are only relative.

On this operation the contract with the Forest Service required the utilization of the trees to a 10-inch top diameter. At the same time there were in force two contracts with private stumpage owners which specified utilization to a 14-inch top. The private owners exacted payment for the small logs but permitted the operator to leave the unprofitable logs in the woods, while the government exacted payment but at the same time required the removal of such material to the mill. The small top logs are of Grade III, and from the graph it can be seen that there was a $29.00 loss in handling the 10-inch logs and a $12.50 loss on the 14-inch. Among logs 18 inches and over there would be a few of Grade II which would lower the average loss and make the limit of profitable diameter about 24 inches for the pine logs. Of course the fir and cedar could not be utilized to even this diameter without additional loss, although the existing contracts make no differentiation in species. The demand for the material produced from the small tops will not pay the cost of production and as a result they are manufactured at a loss which is carried by the more valuable portions of the tree. This results in one or more of the three classes of waste mentioned above.

If the operation is in public timber the loss is theoretically borne by the government and paid for by the people. I say theoretically, because at the present time the lumber market will not return the profit determined by the appraiser of the government timber; this loss thus contributes to the deficit. If private timber is being logged the price of lumber is raised to the limits of competitive selling and further loss results because of a lower interest return on invested capital. On this operation about 5 per cent of the volume was in logs of less than 24-inch top diameter. This amounted to 5 million board feet a year which, translated into dollars, by means of the graph, would mean at least $70,000 annual loss. If spread over the remainder of the cut equally it would require an increase of 74 cents per thousand feet in the selling price. Unfortunately only the more valuable portion of the remaining cut is able to carry this loss and it probably means an increase of several dollars in the selling price of the highest grades of lumber. The small top logs cannot in any sense be considered a by-product. An operation with a limited capacity really allows them to replace other material which might be operated at a profit. The invested capital is therefore operating at a lowered efficiency.

The majority of trees produce logs whose top diameters are less than 24 inches. The utilization of these logs in-

troduces a loss which the operator can, with the forester's help, make into a waste of material, a waste of labor, or a waste of capital. We must try to determine which form of loss is the least harmful to the public and operate accordingly. The profession of forestry is based upon the fact that our raw material—trees—can be reproduced. Their reproduction costs money. Our problem is to determine the comparative merits of saving timber now by using the submarginal logs, as against saving money by leaving these logs and using it to produce more timber. Timber saved now, from the tops of trees, is put upon a market that is already overcrowded with low grades and replaces timber from other localities which may possess a greater merit for the particular use to which it is being put. If the money lost upon its production could be spent for extending the practice of forestry we should obtain a greater amount of timber at a time when it will be needed and can be manufactured without subsidy.

I can see only one logical answer to this problem. For the operation which I have been using as an example, a minimum log diameter of 24 inches would be worth at least $50,000 per year. This amount spent upon the better protection of cut-over lands and the planting of non-productive areas would, I believe, go a lot farther towards insuring a future timber supply than the forcing of low quality lumber on the present market.

We are forced to establish standards for utilization at some point as long as we are unable to utilize the total cubical contents of the tree. Why not use all available information and set up the most scientific limits possible, rather than depend, as we have in the past, upon an arbitrary standard based upon unscientific practices? This question opens up a big field for study as present practice consists in the utilization of unprofitable species, unprofitable individuals of most species, and unprofitable logs from the tree. All are forms of waste and each will have to be balanced against the gain with an unbiased and scientific analysis to determine the best course for future practice. This can be done only by reducing each value to some common factor, as the dollar, and then determining how the dollar can best be spent.

The test of any theory is its practicability, and until the forester can put his practices upon a sound economic foundation, he cannot hope for their ready adoption by the public. On this basis the public forester is in exactly the same position as the private forester. He can for a time excuse uneconomic practices by saying that the government is paying the bill. The time will come when the public will demand to be shown that it is getting its money's worth and it is doubtful if the expenditure of $70,000 a year for the removal of valueless logs from one sale area can stand this test.

THE SCANDINAVIAN GANG SAW AND ITS RELATION TO FORESTRY

By AXEL H. OXHOLM

Director, National Committee on Wood Utilization, U. S. Department of Commerce

SCANDINAVIAN methods of forest management have attracted considerable attention in America for some years. Our foresters have carefully studied these methods, as well as those of taxation and forestry legislation, but have failed often to recognize the important part which efficient wood utilization practices play in making reforestation profitable in the Scandinavian countries. During a two-year visit in those countries, as Trade Commissioner of the Department of Commerce, it was the writer's privilege to study and prepare a report on Scandinavian sawmilling methods. The outstanding fact disclosed by this study was that Scandinavian foresters have succeeded, through efficient forest management, in reducing the financial rotation of their timber crops to a point where commercial reforestation has become a profitable undertaking. One factor which has helped to effect this reduction is the development of highly efficient gang saws. The use of these saws has made it possible to convert sawlogs ranging in top diameter from 3½ to 12 or 13 inches into lumber at a profit.

Shortly after its establishment in 1925, the National Committee on Wood Utilization of the Department of Commerce organized a subcommittee of lumbermen, under the chairmanship of Mr. A. Trieschmann of Chicago, Illinois, to investigate the suitability of Scandinavian gang saws to American conditions. Through the coöperation of lumbermen on the Pacific Coast, a new sawmill was built at Olympia, Washington, and equipped with two of these gang saws. The plant began operation on April 1, 1929, and the committee tested the equipment in June of that year. The test was conducted under the supervision of Mr. Roy F. Morse, General Manager of the Long-Bell Lumber Company, Longview, Washington. In a special report entitled "Test of Scandinavian Gang Saws on Pacific Coast," the committee brought out some interesting facts in regard to this piece of imported sawmilling equipment. No attempt will be made here to describe the machine, since such information may be found in this report, but the following summary of its performance may be of interest:

The raw material on which the test was conducted consisted of logs ranging in top diameter from 6 to 20 inches, or in other words such logs as are commonly left on the ground after logging operations on the Pacific Coast, because their conversion into lumber has not been profitable with equipment heretofore in use.

The cost of operating this type of equipment was found to be considerably less than the cost of converting the same size logs on either band or circular saws.

Unskilled labor can be used to advantage. A second factor which has a salutary effect on minimizing operating costs is the high percentage of over-run obtainable. This is due to the ability of this equipment to handle small logs, and to the use of thin gauge saws. Logs are fed into the machine, without previous slabbing, at a speed of 18 feet per minute.

The surface of the sawed lumber is so free from irregularities that dressing is unnecessary, excepting for purposes where an absolutely smooth surface is needed (such as for flooring and millwork items). When these saws are properly installed and operated, mis-cut lumber is unknown. Both of these factors effect an appreciable economy in raw material.

The result of the test proved the Scandinavian gang saw to be very well adapted to American conditions, even on the Pacific Coast, where stumpage values are relatively lower and labor costs higher than in other forest sections of the country. It is reasonable to expect that these gang saws will prove of even greater service elsewhere, because their principal advantage lies in the saving of raw material.

As a result of this successful test, about a dozen gang saws are being installed in various parts of the country. It is significant that the output of the test mill was sold for export six months in advance, and at even higher prices than those secured for band-sawed lumber of the same grade cut from virgin timber. This was due to the accurate manufacture of the stock.

In many instances it has proved profitable for the loggers to transport logs in tree lengths to the gang mills, where they are cut into suitable log lengths in the mill pond or by a drag saw at the top of the log haul-up. While in most instances the top logs of virgin timber may be of too low a grade to warrant the cost of transportation, yet on second growth timber this utilization of top logs is of great importance.

Under our present methods of operation approximately 25 per cent of the tree is left in the woods as waste after logging operations. Not only does this large amount of wood waste constitute a fire hazard, but it also detracts from stumpage values. Axiomatically, any method of closer utilization which reduces this percentage is of vital interest to foresters and timberland owners. The Scandinavian gang saw, through it ability to utilize small logs effectively, reduces this waste percentage. It is obvious also that the profitable conversion of small timber is of paramount importance to the forester, because it likewise means the reduction of the financial rotation of the timber crop. In many instances, foresters are confronted with the necessity of planning on a rotation of approximately 50 to 100 years to produce timber of saw log size. As logs from 5 to 6 inches up to 18 to 20 inches may be converted at a profit on these gang saws, the financial rotation can be shortened because the forester may produce such size timber in 25 to 50 years or even less.

Anyone familiar with the logging of virgin stands will realize the unavoidable destruction of small trees in the felling of the larger timber. By operating this type of gang saw in conjunction with band saws, it will now be possible, in most cases, to log these smaller trees first, convert them on the gang saws, and then cut the larger timber.

Apprehension has been expressed that these gang saws will increase the cutting of immature trees, and thereby become a menace to this class of timber. This statement at its best is merely hypothetical. Any type of sawmill machinery may be considered a potential danger to young growth. If these gang saws were inexpensive and of the portable type, there might be some reason for this alarm. Because of their high cost, they will not appeal to the small portable mill owner, but will be part of standard mill equipment. It is reasonable to believe that a concern going to the heavy expense of installing a gang saw must be assured of a continued supply of raw material, and will cut its timber accordingly; otherwise, the installation of the machine would not be profitable.

A timber owner planning on a certain output of lumber per year will find that these gang saws, operated in conjunction with band saws, will enable him to produce the desired amount from a smaller area of timberland. In this way the gang saws will extend the life of band mills, and, as the size of his timber decreases, the sawmill owner can gradually change the character of his mill from band to gang saw operation.

Everyone interested in commercial reforestation realizes the danger of the small, inefficiently operated circular mills, which so often produce mis-cut and otherwise poorly manufactured lumber. Wherever the Scandinavian gang sawing system has been introduced, it has effectively entered into competition with inefficient circular mills, and has relieved the public of poorly manufactured lumber by replacing it with accurately cut gang-sawed stock.

A significant fact regarding the Scandinavian gang saw and its relation to reforestation activities, is that the first offer from the lumber industry in a certain state to coöperate with a state organization in its reforestation activities came from a mill equipped with this type of saw. This was purely a commercial proposition.

The gang saws are of great importance also in converting into boards the small stock from management thinnings. Heretofore this stock has usually been too small to process on band or circular saws. Therefore the thinning process has not received the impetus which it would have had if it had been possible to convert these small logs into lumber at a profit. In this manner the gang saws are stimulating reforestation activities and efficient forest management.

The National Committee on Wood Utilization is of the opinion that the introduction of the Scandinavian gang-sawing system represents the most significant development in sawmill technique during the last quarter of a century, and that this innovation will be of the utmost importance to the furthering of commercial forestry in this country.

FINDING ECONOMIC FACTS AS A BASIS FOR FORESTRY EXTENSION PROGRAMS

By CHARLES A. GILLETT
Extension Forester for Arkansas

EXTENSION foresters agree that the lack of basic economic facts has materially handicapped them in developing programs, either for the state or for individual counties, which would make their teachings more effective. Until recently, forestry programs have been made and carried out in terms of better practices without economic facts to support them. The best forestry extension results are achieved when economic factors are available to show the effect of forests and their industries upon the standard of living of an individual, community, county, or state.

At a meeting of extension foresters of the Northeastern States held in Washington, D. C., February 26-28, 1929, the subject, "How to find and apply economic material as a basis for extension programs," was discussed at length. Those present agreed that it was necessary to obtain from all sources possible all economic material available before initiating a project. It was also agreed that some projects had been seriously handicapped because of the lack of economic facts. There was discussion also concerning the amount of work which should be done by extension forces in obtaining state and county data. It was agreed that these forces should go only as far as is actually necessary to obtain essential and pertinent facts. Research can aid materially in helping to obtain part or all of this practical information.

The value of woodland improvement is recognized by all foresters. Woodland improvement projects have been initiated by a number of extension foresters, many of whom were handicapped in developing such extension methods as would result in a large scale adoption of forestry practice because basic information concerning markets and marketing is lacking. Woodland owners are interested in markets for the material produced before they will spend extra money or effort in some special method of handling timber.

The writer, in connection with his duties at Cornell University during the year 1928-29, conducted a survey of the wood-using industries of Broome, Chemung, and Tioga Counties, New York, with particular reference to the marketing of the forest products from farm woodlands. With this basic economic material at hand, it is possible to develop a forestry program that should aid materially the agricultural situation of the respective counties.

How the Survey Was Made

The survey was made possible by the contribution of $200 by the New York State Committee on Wood Utilization and the Department of Forestry at Cornell University. Thirty-two days were required to complete the survey at a

cost of $192.23 for field expense exclusive of salary. Twenty-six names of wood-using industries operating in these three counties were available, but by coöperation with business organizations, such as commercial clubs of the various cities and villages, an additional list of 40 wood-using industries was secured. With this list, a schedule was made up whereby each industry could be visited with as little travel as possible. Officers of the industries were more than pleased to co-operate in such a project.

The survey also obtained information concerning the amount of wood in raw material form shipped out of the counties. Officers of all the local railroads made this part of the survey simple by writing letters of introduction to their station agents. Since the owner of any sawmill of size would ship lumber or railroad ties, a list of the sawmills was secured. A number of these sawmills were visited to determine the views of their owners on the utilization problem, as well as to get data on manufacturing and marketing costs. Several woods operations were visited to obtain information on methods, and costs of stumpage sales.

Results of Survey

The 66 wood-using industries were found to use a total of 90,204,000 board feet of lumber in 1927 of which 10,330,000 board feet came from woodlands in the counties concerned. One of the most significant facts brought out by the survey is that these wood-using industries signified their willingness to use 20,361,000 board feet of local woods in 1929. This is a 100 per cent increase over that used in 1927. (See Tables 1 and 2.)

Table 1

CLASSIFICATION OF WOOD-USING INDUSTRIES BY AMOUNT OF LUMBER CONSUMED, 1927

Lumber consumption thousand board feet	No. of industries
Less than 100	13
100– 500	14
500–1,000	10
1,000–2,000	16
2,000–3,000	7
3,000–5,000	3
Over 5,000	3
	66

Table 2

LUMBER CONSUMPTION OF WOOD-USING INDUSTRIES, BY COUNTIES, 1927

County	No. of industries	Total annual consumption, bd. ft.	Total local wood used, bd. ft.	Local wood usable in the future, bd. ft.
Broome	34	53,728,000	4,875,000	12,321,000
Chemung	20	24,377,000	2,252,000	4,640,000
Tioga	12	12,099,000	3,203,000	3,400,000
Total	66	90,204,000	10,330,000	20,361,000

Tables were compiled also showing for each of the commercial woods grown locally the industries using it, together with the amount. With these market data it is possible, with little effort, to satisfy inquiries concerning a market for wood products.

It is a recognized fact that the average woodland owner knows less about the value of his forest products than he does of any other crop on his farm. To help

remedy this situation in Broome, Chemung, and Tioga Counties, considerable marketing information was obtained and prepared in tabular form to aid the farmer to determine his own stumpage value, the following facts being known: Amount of timber owned by species; average distance of the skidding; costs of manufacturing; hauling distance to mill or railroad station; and the value of the lumber at the wood-using plants. Table 3 shows the average range of prices paid f. o. b. factory for log-run lumber of local species.

TABLE 3

AVERAGE RANGE OF LOG-RUN PRICES PAID F. O. B. FACTORY FOR LOCALLY PRODUCED LUMBER, 1927

Kind of wood	Range of price Per M bd. ft
Birch	$35–$40
White pine	35– 50
Hemlock	30– 35
Basswood	40– 60
Hard maple	40– 60
Ash	50– 60
White oak	55– 60
Red oak	45– 55

TABLE 4

CARLOADS OF FOREST PRODUCTS SHIPPED OUT OF BROOME, CHEMUNG, AND TIOGA COUNTIES, 1927

Kind of product	Broome	Tioga	Chemung	Total
Mine props	609	140	...	749
Railroad ties	30	184	47	261
Lumber	82	108	53	243
Switch timber	2	26	...	28
Logs	3	26	63	92
Mine rails	24	32	2	58
Mine ties	42	10	...	52
Door boards	21	26	15	62
Decking	...	4	...	4
Sawdust	...	4	...	4
Fence posts	12	1	1	14
Pulpwood	...	1	7	8
Fuelwood	...	1	...	1
Mine roofing	47	...	...	47
Poles	4	...	...	4
Total	876	568	188	1,627

In 1927, 1627 carloads of forest products were shipped from the various points in Broome, Chemung, and Tioga Counties, as shown in Table 4. Most of this went to a destination outside of the counties.

Analysis of Results of Survey

The facts obtained from the survey can be used in many ways to advance forestry and incidentally to improve agriculture in the three counties. In the first place, facts have become available which point to an improved land utilization policy through the reforestation of submarginal lands.

The wood-using industries and lumber distributing plants of Broome, Chemung, and Tioga Counties in 1927, used 10,330,000 board feet of lumber from woodlands within their own boundaries. In addition, 305 carloads averaging 18,000 board feet each, or a total of 5,490,000 board feet, were shipped out for use elsewhere. This makes a total of 15,820,000 board feet of lumber taken from the woodlots. To yield this quantity of sawed lumber a volume of 2,636,667 cubic feet was consumed. An additional quantity amounting to 10,709,235 cubic feet consisting of cordwood, ties, posts, and mine timbers was used. The total drain of forest products from the woodlands in the three counties was 13,345,902 cubic feet. Estimating each acre of forest to be capable of producing 40 cubic feet or half a cord a year, 333,649 acres would be required to meet the 1927 drain. There are only 186,243 acres of forests on the existing farm area in the three counties. If the woodlands of the counties are to continue to support the annual drain made upon them, thousands of acres of the cut-over and sub-

marginal lands must be converted by artificial means to the growing of forest crops.

The above figures also show the possibility of practising woodland management to derive the greatest growth from the existing woodlands. The survey could be well supplemented by information concerning the actual forest conditions. Time did not permit to go far into this phase, the figures of the census of 1925 being relied upon. The actual forest conditions could be obtained at a very reasonable figure by employing the plan worked out by J. N. Spaeth in New England.

Information was obtained in the survey which will serve as a basis for developing our educational program with the sawmill men to improve their products and thereby also decrease wood waste. The objections to using local woods were secured from the wood-using industries. Some of their objections are as follows:

1. Poor sawing.
2. Improper seasoning.
3. Poor quality.
4. Stain and warp as a result of poor sticking.
5. Must buy dressed lumber.
6. Costs too much to re-handle and remanufacture.
7. Have markets already established.

By decreasing wood waste in the milling operation, farmers should realize a larger return for their forest products.

Educational Program Based on Survey

Basic economic facts, such as have been collected, would not be worth the time nor the money spent in obtaining them were it not for their application through educational measures. The survey has shown the market for home-grown lumber and the inadequacy of local forests in supplying that market. The educational program based on this survey should capitalize these facts fully.

An illustration of how the market information may be made available to farmers can be found in the demonstration already established on the S. T. Wheat Farm in Broome County. Briefly, the demonstration established by the "Maryland Plan" is as follows:

A 50-acre tract was selected at a strategic point. A reconnaisance trip was made to this tract to determine the advisability of using it as a demonstration. Three days were spent in marking the timber to be cut. The best forestry practices were called into operation in marking. Two men and all expenses were furnished by the owner of the timberland. A letter was prepared and sent out to a list of wood-using industries who, in the survey, expressed a willingness to buy the species represented. This letter showed the number of trees for sale by their diameter classes and gave other necessary information concerning the location of the tract. A valuation sheet was then prepared for the use of the owner. This sheet showed the estimated board foot contents and the stumpage value of each species. A sample timber sales contract was also furnished. The demonstration area furnishes an excellent place for the Broome County Extension Agent to hold meetings in woodland management. These demonstrations can be fully utilized as units of proper forest management only when utilization and marketing facts are available.

In addition to the demonstration method of making marketing information available to farmers, a card index is kept in the office of the extension forester which shows the specifications of the various wood-using industries and the markets for the various kinds of lumber. Any farmer desiring this information may obtain it by writing the extension forester.

Farmers are dependent upon better local manufacturing methods to get the best prices for their forest products. An educational program should include sawmill schools. The survey ascertained the objection to the use of home-grown lumber sawed by portable mills, and through sawmill schools many of these objections can be overcome. All sawmill operators would be invited to attend the sawmill school. Demonstrations would be given in saw filing, proper sawing so as to get the most out of the logs, grading, piling, methods of cost accounting, and any other information which might be deemed essential to aid sawmill operators in better manufacturing. The extension forester at Cornell is planning to hold sawmill schools in the counties during the winter.

Since facts resulting from wood utilization surveys are a prerequisite for education in proper forestry practices in woodlands, similar surveys should be made in other counties and in other states, and the information made available to the existing extension agency.

REVIEWS

Der Waldbau (Silviculture). By Alfred Möller (posthumous). *Pp. 560, figs. 60, pls. 11. Julius Springer, Berlin, 1929. Price, RM. 42.*

Dr. Alfred Möller, although Director of the Forest Academy at Eberswalde at the time of his death, is not as well known to American foresters as he should be. This may be accounted for largely by the fact that his greatest achievements were undoubtedly in the fields of forest pathology, mycology, wood decay, and plant physiology. Among forest pathologists and mycologists, Möller is probably best known as the editor of "*Hausschwammforschungen*" and for his mycological work in the tropics. It is only natural, therefore, that he should approach silvics from a mycological and physiological point of view, and in so doing he has made a distinct contribution to a much neglected subject.

Der Waldbau is an outgrowth of two courses of lectures given by Möller to forestry students at Eberswalde, one dealing with the significance of fungi in the life of the forest and the other with the physiological basis of silvics. These two lecture courses were revised and augmented by Möller in 1919, but his death prevented him from putting them in final form for publication. This task was completed by his wife, Helene Möller, and by Dr. Erhard Hausendorff, Oberforster in Grimnitz.

Because *Der Waldbau* is the first of a two-volumes series, the second of which is not yet available, the reviewer finds it most difficult to obtain a proper perspective of the book. To many readers it may appear top-heavy with pathology and mycology, but this top-heaviness might disappear if the complete work were considered.

Of some 560 pages in the first volume, 306 deal with the significance of fungi in the life of the forest. This discussion is truly delightful. It is here that Möller is at his best. Never does he lose sight of the "biologische Einheit des Waldes," and the wealth of his experiences and observations on the importance of fungi in the biological unity of the forest are woven together to form a rational and interesting philosophy of silvics.

In general Möller regards fungi of first importance to the forest, as organisms causing the decomposition of the annual crop of leaves, twigs, branches, etc., in the upper layers of the soil. In these upper soil layers, too, are found those mycorrhiza-forming fungi which play a most important rôle in the life of the forest. In the second place, fungi are important in the life of the forest as the cause of some of the most imporant diseases of forest trees; and thirdly, fungi are important as the cause of decay of sawn lumber and timbers.

In the portion of the book dealing with the physiological basis of silviculture, the forest is also regarded as an organism and

all of the factors of soil, climate, man, and animal influencing that organism are considered. Möller's interest and training in plant physiology have prepared him to discuss the physiological aspects of silvics in great detail. Much of this disscussion is more or less in the nature of an historical résumé of the development of plant physiology, particularly of that phase of plant physiology applicable to trees.

There are many statements in *Der Waldbau* with which the individual reader may not agree. This could hardly be otherwise, but the reviewer is inclined to minimize rather than emphasize the importance of such disagreements. The book has been prepared as a text for German forest students, and as such must be more or less general.

On the whole, *Der Waldbau* will be found of value to anyone interested in more than an empirical silvics. If one reads German fluently, one will be enchanted with Möller's formal, yet at the same time personal, method of presentation. It is hoped that we may some day have a similar work in the English language. Part One at least is well worthy of translation.

HENRY SCHMITZ.

Plant Competition. An Analysis of Community Functions. By F. E. Clements, J. E. Weaver, and H. C. Hanson. *Carnegie Institution of Washington Publication No. 398. Pp. 340, pl. 32, fig. 30. 1929.*

This substantial contribution from the Carnegie Institution deals with a process which is almost universal and of vital interest in forestry. Although only one section is devoted particularly to experiments with forest trees, there is much in the other parts which is suggestive for foresters and especially those interested in investigative work.

The publication contains three distinct parts. The first comprises a history of the competition concept, in which 34 pages are devoted to 42 brief, non-critical reviews of earlier work. The idea of competition is traced from 1305 up to the present time. The reviews include eight dealing with competition in the forest, and the experimental studies of foresters and others in the United States, England, Finland, and Russia are treated.

The second part, including the bulk of the publication, deals with the details of the many and intensive experiments which have been carried on by Weaver and Hanson at Lincoln and Weeping Water, Nebraska, from 1924 to 1927. These experiments include cultures under natural conditions, under the partial control of field plots, and under the more complete control of garden and greenhouse supplemented by laboratory methods. This series, using the same species, enabled the interpretation of results in reverse order from laboratory back to the natural field phenomena.

The records and measurements taken and presented include temperature, humidity, evaporation, wind movement, light intensity, soil moisture in several forms, nitrate content, root development including depth, spread, working level, and degree of branching, heights, number of shoots, diameters, number of leaves, leaf length and width, dry weight, leaf area, leaf structure, percentage mortality,

stomatal behavior, starch content, conduction, root pressure, sap content, and transpiration. The text is supported by frequent excellent illustrations, but apparently the authors have scruples against the use of graphs for the data are presented in 133 tables without the use of a single graph, although much of the material involves seasonal development and would appear to be susceptible to effective graphic presentation.

One section is devoted to the competition between different species of grasses and herbaceous plants in the high and low prairie. The reappearance of certain species in fenced enclosures, after they had been almost eliminated by overgrazing, will be of interest to those concerned with this phase of forest work.

A second section outlines experiments with forest tree seedlings in the transition between prairie and woodland. In the low prairie honey locust showed a mortality of 31 per cent; box elder, 51 per cent; elm, 68 per cent; silver maple, 73 per cent; and ash, 81 per cent. These percentages increased to about 65 per cent for all species in the shrub thicket of sumac and to 90 per cent in the high prairie.

In the experiments to evaluate the effects of shading and root competition for moisture, it was found that by eliminating both factors by mulching, the survival was 69 per cent; by clipping the adjacent grasses and thereby eliminating the shade only, the survival was 38 per cent; by watering but leaving the shade it was 21 per cent; and in the unaided competition with the prairie grasses it was only 8 per cent. Tree survival, on the whole, was lowest in the prairie, next in the red oak forest, and best in the open bur oak type. It is concluded that neither forest nor shrubs can invade the high prairie, and that in the low prairie the forest margin advances or retreats with the wet and dry years and that the competition is in a state of unstable equilibrium under present climate.

The section on competition in cultivated fields and in the greenhouse includes experiments with sunflower, wheat, cocklebur, and bunch-grass grown in pure cultures with different densities. The results are striking in showing the influence of increasing density in reducing the growth except in height. Height growth increases during the early stages as a result of competition and later decreases as the competition becomes more intense, especially for soil moisture. Leaf area and dry weight were found to be the two most reliable criteria of growth. As between the different factors in competition, soil moisture was found to be the most important, shade second, and nutrients third. However, it was also found that the reduction of light could be carried much further than that of the other factors before serious effects were observed.

In the third part, of 20 pages, the nature and rôle of competition are reviewed. The treatment somewhat resembles that in the earlier publication on plant succession, with slight modifications and comment on more recent work, particularly that of Yapp. The final section suggests the lines along which further studies of competition are needed. Several of them are suggestive in connection with forest research. They include (1) competition and functions of the individual plant and the physico-

chemical process involved, (2) interaction of competition, adaptation, and correlation, (3) community functions and succession, particularly the need of continuous records and experiments on the same areas through the successional development, (4) competition and its significance in the direct action of insects and animals on plants and on each other, and (5) the rôle of competition in forest, range, and field crops.

A bibliography of 198 titles adds to the value of the publication for reference purposes.

If one were to suggest ways in which the publication might have been improved, he would certainly mention the lack of unity between its three parts. The first rather brief review of previous work contains conclusions and statements which are obviously inconsistent with some of the results and conclusions presented later. Yet no mention is made of the inconsistencies and no attempt is made to show wherein earlier work was defective. Summaries in the main part of the text help to bring out the principal findings and conclusions, but it would have been possible by graphic methods and by a less monotonous recital of a multitude of details to have made the experimental work stand out more clearly. Finally, the last section, in its abstract treatment of competition, is entirely unconnected with the detailed and concrete presentation of the experimental results.

Notwithstanding these comments, the publication will well repay study by foresters engaged in forest or range research, and by all who are interested in the factors which affect growth and survival.

J. KITTREDGE, JR.

The Structure and Life of Forest Trees. By M. Büsgen. Third edition, revised and enlarged by E. Münch; English translation by Thomas Thompson, University Lecturer in Forestry, University College of North Wales, Bangor. *Pp. 436, figs. 173. Chapman and Hall, Ltd., London, 1929. American edition, John Wiley and Sons, New York, 1929.*

Dr. Büsgen's book, "Bau und Leben Unserer Waldbäume," first appeared in 1897, the translator informs us and goes on further in his preface:

"The second edition appeared in 1917, and the progress made in all branches of the subject in the intervening years necessitated a considerable enlargement and revision of the book. Büsgen died in July, 1921. The present edition owes much to the editor, Dr. E. Münch. Whilst preserving the main lines of Büsgen's work, he has expanded and rewritten many of the sections and has himself contributed in no small degree to the advances which have made the further revision and enlargement of the book necessary. In particular he has given in Chapter XII, 2, the first account in forestry literature of his own theory of the circulation of sap and its mechanism, and has also added an entire new chapter on 'Local Races,' on which he is a recognized authority."

So much for the history of this bulky volume, one decidedly worthy of perusal. The translation is in excellent English, the illustrations are clear and apt, and the typography is particularly good.

The title expresses the breadth of content of this work. Fifty pages are devoted at the outset to the form of the

tree, going into great detail to show the factors that influence form. The treatment here as elsewhere is thorough and supported by many citations, chiefly of European writers. Chapter II in half as many pages has put in compact form a mass of information on buds and shoots arising therefrom.

Chapters III and VII deal with the properties and life processes of the meristem of the tree, the xylem, the tree "rind," (as the translator calls the part outside the cambial sheath), the annual ring, and, finally, the anatomical basis of technical properties of wood. This part comprises approximately a hundred pages dealing with the origin and structure of the stem.

Chapters VIII to XII constitute another main portion of the volume, and treat of the morphology and physiology of the leaves and the roots, the water economy of the tree, the mineral nutrients, and the movements and transformations of substances in the body of the tree. The balance of the text consists of a chapter dealing with flowers, fruits, and seedlings, the chapter on local races of trees mentioned above, an index, a list of authors cited, and a list of common and scientific names of plants.

This sketch of the contents has been given to show what a storehouse of information about forest trees is to be found in the book. The translator has done a great service to botanists and foresters in making this work available in English to serve as it well may as a reference for advanced students and research workers.

With the present interest in heredity of forest trees, Dr. Münch's chapter on "Local Races" should especially be read by foresters.

S. N. Spring.

Forest Fires and Other Verse. Collected and edited by John D. Guthrie. *Dunham Printing Company, Portland, Ore., 1929. Pp. 321. $2.50.*

"Forest Fire and Other Verse," another anthology by John D. Guthrie, comes from the press just an even decade after its predecessor, "The Forest Ranger." This entirely new collection will be welcomed by lovers of outdoor verse, and it should meet with a particularly sympathetic response from the host of old-timers of the forestry profession who know the joys and tribulations of the unblazed trail.

Though the finished style and content of true poetry are often sacrificed in this verse for a rougher expression and an unconventional choice and treatment of subject, there is no mistaking the heart appeal that many of the selections possess. Will Barnes' "Sunrise on the Desert" is one that will revive the memories of many an old-timer who has spread his tarp under the Joshua trees. No one who has wandered, like the "blue crows," among the piñons, can easily resist the haunting music of "Ho! Compadres Piñoneros!" Poetry tells many things that would never be expressed in any other way. This collection is therefore a valuable record of these developmental days of forestry that would otherwise be forever lost.

Most of the time-cherished subjects are here. Forest fires; the forest ranger—his life, duties, marital and other vicissitudes, and his perpetual feud with regulations; equipment—autos, trucks, chuck boxes, the McLeod fire tool; forest beasts—porcupines, Gila monsters, packrats, chipmunks—disport themselves in dubious verse or verse-like prose. "E. de

Floochee " springs fluently into his impeccable French-Canadian dialect. Range appraisal and logging and silviculture are reviewed, not too respectfully. Derisive verse is aimed at animate and inanimate things alike—from supervisors and district inspectors to the lowly forest assistant, the " standard map file," and the Oliver typewriter. Forest nursery rhymes, ostensibly for the young, embody a particular meaning for the most sophisticated. A few painless gibes reach personal targets. But it is rather naturally the forest ranger—and the more or less untamed western ranger, at that—who occupies the center of the picture, until one overwrought contributor sobs

" I've malice toward none, and I've charity for all,
But another ranger pome and I'll break down and bawl! "

The good verses make the book well worth the price, but it is safe to say that real interest to foresters will lie in the perhaps less poetic but vigorous and intimate selections concerning the life and adventures of the foresters themselves. The book contains nearly 350 verses by 150 contributors; " The Forest Ranger " had 90 verses by 40 writers. Following the ten-year interlude an increased variety of subjects was to be expected, and this expectation has not been disappointed. It is to be regretted, however, that the ten years since the appearance of " The Forest Ranger " have not produced more forestry songs. Evidently the long-awaited musical period in our development is not yet. Of the sixteen " Songs for Foresters " collected at the back of the volume, there are only ten for which an inkling is given as to the music, and of these there are only two or three that have qualities suggesting currency in the profession. One of these is the well-known " Down Under the Hill." Another, and a very welcome one, is " The Silviculturist." (The latter, by the way, is wrongly attributed to the Yale Forest School, 1926. Its actual author is T. J. Mosley, of the Forest Products Laboratory.) It is rather surprising to the reviewers that Lovejoy's singable ranger's song was not included in either the 1919 or the 1929 volume.

" Forest Fire and Other Verse " deserves a prominent place, along with " The Forest Ranger," among the more solemn green volumes on the forester's bookshelf. Both books are good—good for the old-timer in reminiscent mood and for the budding forest assistant. They weave the spirit of forest and trail into the dry web of forestry routine. The forestry profession is once again indebted to John Guthrie for his very real contribution to the living spirit of forestry.

E. H. Frothingham,
C. R. Hursh.

How Fast Do Northern Hardwoods Grow? By Raphael Zon and H. F. Scholz. *Research Bulletin No. 88, Agricultural Experiment Station of the University of Wisconsin, in cöoperation with the Lake States Forest Experiment Station, U. S. Department of Agriculture, and the Wisconsin Conservation Commission. Pp. 33, 14 tables, and 11 figures, illustrations and graphs. 1929.*

Based on 24 sample plots covering in all 112 acres in the northeastern counties of Wisconsin, the authors have made a study of the growth of sugar maple,

yellow birch, hemlock, and associated species after different degrees of cutting.

The areas studied were either virgin or had been cut off 10 to 30 years ago by the lumbermen who, as dictated by the market, usually cut only the best part of the stand, a method which may be classified as "selective logging." Clean-cut areas which had escaped fire were more difficult to find, but a couple of plots of this kind were also measured.

The original stand before cutting was reconstructed from the old stumps, the age of the cutting and the growth in diameter were obtained by means of increment borings, and the board foot volumes were obtained by the usual method of cruising what was merchantable.

It is interesting to see that the annual growth in the average virgin forest with a volume of 12,000 board feet is about 213 board feet per acre. This, of course, is counterbalanced by windfall and rot, so that the volume remains fairly constant. In the virgin forest basswood is by far the fastest grower, requiring 7 years for one inch of diameter growth, while sugar maple requires 10, beech and hemlock 11, and yellow birch and elm 12 years.

Most of the measured plots were situated in partially logged-over areas. In 17 plots covering 104 acres 26 to 96 per cent of the merchantable volume had been cut, with most of the cuttings running about 50 per cent.

The average annual growth was about 145 board feet per acre after cutting. The best growth was 240 board feet on a plot cut 54 per cent 16 years ago, when a stand of 4373 board feet was left. The poorest growth, 53 board feet, occurred on a plot where 96 per cent had been removed 24 years ago, with a volume left of only 722 board feet; but it is, of course, not quite fair, as the authors point out, to measure in board feet a practically clean-cut area with a stand only 24 years old. Another area cut 95 per cent 18 years ago had grown 116 board feet annually.

Speaking in terms of diameter-limit cutting, a 20 to 22-inch limit in which 42 to 54 per cent is removed gives 185 to 195 board feet of subsequent increment annually per acre; a 14 to 16-inch limit, with 75 to 88 per cent removed, gives 150 to 170 board feet; a 12 to 13-inch limit, removing 91 to 97 per cent, gives 110 to 145 board feet; and an 11-inch limit, removing 98 to 99 per cent merchantable volume, gives 45 to 65 board feet. These results are based on a stand of 13,000 board feet.

Partial cutting in the northern hardwood forest tends to increase the amount of sugar maple at the expense of yellow birch, basswood, and elm.

An interesting graph by Gevorkiantz showing the relation between the amount of merchantable timber left and the per cent of volume growth on the cut-over areas is included in the bulletin.

The only clean-cut or almost clean-cut areas possible to find are represented by two plots 24 and 80 years old. The former, 3 acres in size, is the same as that included above under the results from partial cutting; but here on the clear cutting the plot is reported to produce 61 board feet per acre instead of 53 which is correct. The latter plot, now 80 years old, was the only close approximation to a clean-cut area found. The total volume of this plot was 4,412 board feet, which, divided by the average age of the stand, gives an annual increment of 55 board feet per acre. The conclu-

sions drawn are therefore that clean-cut areas yield only 55 to 65 (53?) board feet per acre per year. No description is given of the size, location, or character of this plot, although it is the only real test presented on the application of clean cutting.

Pictures and figures are included in the bulletin from the recent beech-birch-maple study by the Pennsylvania Department of Forests and Waters, but the figures are not given in full. The authors cite an 80-year hardwood stand from this study which is 71 feet in height and 8.6 inches D. B. H. (should be 9.6 inches according to the authority cited), but they do not mention that the total volume of this stand is 4,854 cubic feet of which 50 to 60 per cent is estimated to be sawtimber. This gives a considerably higher annual production in board feet than the 80-year-old stand from Wisconsin. There is no doubt in the mind of the reader of "How Fast Do Northern Hardwoods Grow" that the authors are in favor of selective cutting.

To the mind of the reviewer the bulletin is very interesting and valuable. It analyzes old, partially logged-over hardwood forest and tells in sawtimber language what is happening after different degrees of cutting, but it would have increased the value of the study if growth and stands had been measured and computed also in cubic feet.

Furthermore there is not material enough in the study to give the authors the right to praise as they do partial logging in comparison with clean cutting. The clean-cut areas studied are too few and the observations too vague. It would in this connection have been a great addition to the study if the financial aspect had been touched upon.

From the earliest days partial cutting, where only the best trees are taken, has always proved to be a poor forestry system. It is due to this practice that so many forests in this country, Europe, and elsewhere are producing so low a yield. The first, the second, and perhaps the third cut may give something, but the yield will still be on the decline. The logging is more difficult than in even-aged stands and the form of the timber generally poor. The selective system has one advantage: it preserves better than any other system a good humus condition and it has therefore advantages over any other system on sites where the humus is in danger of deteriorating.

The clean-cutting methods may often fail, though many good stands have originated by this method in the northern hardwoods type of the Northeast. But why not then produce an even-aged stand under the shelter of scattered older trees which can be removed with profit when the reproduction is well started? That is a safe and easy way of handling the hardwood forest.

SVEND O. HEIBERG.

Yield of Jack Pine in the Lake States. By A. E. Wackerman, R. Zon, and F. G. Wilson. *Research Bulletin 90, College of Agriculture, Univ. of Wisconsin. 1929.*

This bulletin gives yield tables for three sites of jack pine and volume tables in cubic feet and in cords based on 1400 trees, in board feet by the International one-eighth inch kerf rule based on 1000 trees, and in board feet by the Scribner Decimal C. rule based on 800 trees. The bulletin is written for the general reader, and very successfully explains in non-

technical language the nature and uses of yield tables. At the same time it furnishes for jack pine satisfactory yield and volume tables similar to those which are rapidly becoming available for most of our species of economic importance. The tables are preceded by a concise and clear account of the silvicultural characteristics of jack pine which have been responsible for its taking the place of white and red pine on many areas. A clear non-technical discussion of "site" and "density" is also given for the purpose of explaining how the yield tables are to be used. The explanation of "site" is particularly good.

The usual yield-table figures are given for three sites designated good, medium, and poor, with average heights of dominant trees at 50 years of 66, 53, and 40 feet. The height curves, basal area curves, and curves of total yield in cubic feet are anamorphic, *i. e.*, the values for one site bear the same percentage relation to the values for either of the other sites at all ages, as is the case with all the new yield tables. The cubic-foot yields and the cubic-foot volumes in the volume tables are inclusive of bark. This appears unfortunate to the reviewer, particularly as pulp manufacture is mentioned as one of the important uses of jack pine, for which of course the bark is valueless.

T. W. DWIGHT.

Forest Planting in the Lake States. By Joseph Kittredge, Jr. *U. S. Dept. of Agric. Bull. 1497. Pp. 88, pl. 6. 1929.*

This bulletin constitutes a highly valuable contribution to the advancement of forest planting in the Lake States, since it gives the results of a comprehensive study of past and present work by all agencies in the region.

The importance of the subject is brought out forcibly by stating that the estimated area in need of some degree of planting is 20 million acres and that the area planted, including that in 1926, is only 0.33 per cent of the above total. Of the area planted, 43 per cent has been restocked by the State of Michigan.

About 400 plantations, mostly from 5 to 20 years old, were examined. The principal species planted and the percentage of the area covered by each are: Norway pine, 60 per cent; white pine, 25 per cent; jack pine, 7 per cent; Scotch pine, 5 per cent. Thirty-four other species have been used in small amounts. The most successful in the later group have been Norway spruce, white spruce, cottonwood, Russian poplar, boxelder, white ash, and green ash. The greater part of past planting has been done on sandy lands.

The more recent state and federal plantings show an average survival of 85 per cent. Attempts at direct seeding have failed in most cases.

The typical planting sites are classified and suitable species recommended for each class.

As to rate of growth, the leading species are rated in the following order, beginning with the most rapid: Cottonwood, jack pine, European larch, Norway pine, white pine, white ash, basswood, red oak, white spruce, sugar maple, white cedar.

Stumpage values (1925) are given for white and Norway pine sawtimber as $10 to $15 per thousand board feet, for white spruce pulpwood as $2 to $5 per

cord, and for jack pine pulpwood as $1 to $3 per cord.

Stress is laid upon the value of mixed plantings. Possibly desirable mixtures and methods for securing them are given.

Very interesting figures are presented on the effects upon survival of various planting seasons and of different ages and kinds of stock in the case of the more important species on different sites.

A discussion of planting methods brings out the superiority of the furrow method on all sites upon which it can be used.

The effects of different spacings are cited and those between 5 by 5 and 8 by 8 feet are recommended.

The causes of loss and damage have been numerous but most of them not especially serious. In the past, the heaviest losses have been due to fire, unfavorable weather, and rabbits. Other causes, as white pine blister rust and certain insects, may increase in seriousness in the future. Methods of controlling losses, due to the various causes, are given.

Pruning, release cuttings, thinning, and cleanings are discussed briefly.

Planting costs are analyzed and tabulated for the important species, sites, and methods.

One set of tables gives the indicated yields of Norway, white, and jack pines on the basis of past growth in well-stocked natural stands. Another set shows the stumpage prices that must be obtained to earn rates of interest from 3 per cent to 6 per cent with different species, rotations, and costs for planting, taxes, and protection.

It is refreshing to see attention called by the author to the fallacy of charging compound interest in the case of long-lived, going operations, where timber is being cut each year as well as planted.

The bulletin concludes with brief discussions of desirable forest policies for private and public owners, state aid to local communities, state aid to private planting, forest taxation, and national aid to states. Some interesting figures of the financial possibilities in a comprehensive state planting program are given.

The appendix includes a rather extensive bibliography.

L. J. YOUNG.

Secondary Succession in the Climax Forest Formations of Northern Minnesota. By Harvey Stallard. *Ecology 10: 476-547. 1929.*

This comprehensive article of 71 pages, including 26 figures and 46 full page plates, is based upon the results of a detailed field study in the northern counties of Minnesota from 1912 to 1916.

The work covers a careful study and analysis of the development of the secondary successions found on all the different site conditions existing in the coniferous area of the state. The subclimax types are fully described in each situation, and each is followed through to the apparently inevitable conclusion that white and Norway pine—white pine in the wetter locations, Norway in the drier regions, and a mixture of the two on the median sites—form the climax types of the entire coniferous area.

Most of the statements in regard to the development of the herbaceous and shrubby growth, and of the birch, popple, larch, and jack pine stands, will seem familiar enough to the forester, but

he may be surprised to learn that Norway and white pine seedlings, more especially Norway seedlings, succeed in situations where spruce and balsam fail for lack of light.

These conclusions are more or less revolutionary and would seem to warrant more support than they are given in the article. If true, most of the old ideas in regard to underplanting and regeneration cuttings will need revision. It will be well worth the forester's while to look over the evidence.

The article contains some very interesting data on the changes in light and soil moisture which take place with the changes from herbaceous cover to shrubby formations, and from a cover of shrubs to forest growth. The results of succession are covered as well as the causes.

Unfortunately the writer did not stop when he had completed a description of his studies. He goes on to make some most extraordinary "applications" of it. An outline of the silvicultural practice to be followed in the whole region, suggestions for flood control, the necessity for the adoption of a better state forest policy, the regulation of camp fires and smoking habits, together with a light touch on state parks and the conservation of fish, are all included.

It may be that a paper is of greater scientific value because it is filled with words unhallowed by dictionary sanction, but the Bible has been much more effective since its translation into English. The paper abounds in such phrases as "contain propagules of one or more stages," "or provide for the rapid ecesis of invaders," or "a mictium of basswood, birch, elm, ironwood, and scrub maple." It sounds suspiciously like a present-day physician preparing to charge a patient $10 for diagnosing a cold in the head.

It is, however, an article well worth translation.

E. G. Cheyney.

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Die Naturverjüngung der Eso-Fichte *Picea jezoensis*, ihre Grundbedingungen nebst praktischen Anwendungen. (Natural reproduction of Eso spruce, chief requirements and practical application.) By Yoshio Sato. *Research Bulletin of the College Experiment Forests, College of Agriculture, Hokkaido Imperial University; Vol. VI. Pp. 354, pl. I-VIII. Sapporo, Japan. 1929.*

Eso spruce, *Picea jezoensis*, is one of the most important timber species of Hokkaido, where it occurs principally with Sachalin fir, *Abies sachalinensis*. Up to this time the management of the two species has been the same, although they show very different silvicultural characteristics. Thus, the Sachalin fir germinates and thrives under forest cover, while Eso spruce seedlings are weak and develop poorly. As a result the reproduction of Sachalin fir in the conifierous forests of Hokkaido is increasing while that of Eso spruce has failed. Experiments to determine the silvicultural characteristics of the spruce have been under way since 1922 and more extensive investigations are planned with special reference to finding a practical method for securing natural reproduction.

The most favorable degree of crown cover for Eso spruce is 45 to 70 per

cent, under which germination and development are both good. From the standpoint of overhead light, the shelterwood system is suitable, but the spruce is shallow rooted and may be wind thrown by storms, thus endangering the reproduction. Under the selection system the young trees suffer greatly from deficient light and develop only poorly, with the further danger of excessive drying out of the soil and consequent death of the trees.

Experiments show that for young spruce, particularly natural reproduction, light from the side is necessary. Dispersed side light from the south, southeast, and southwest gave best results. As a result of the experiments carried out, the following three natural reproduction systems were applied in the University forest of Tomakomai:

1. The simple strip shelterwood system (saumweise Schirmschlagverfahren). Particular consideration is given to storm danger. This system is applied with good results in the Sachalin fir stands in the research forest of Nopporo.

2. The border-cutting system (Blendersaumschlagverfahren) according to C. Wagner's method; somewhat simplified.

3. The system involving a cleared strip with reproduction from the side (saumweise Seitenverjüngungsverfahren). A narrow clear-cut strip is made along the forest border and is reproduced through natural seeding from the side.

Extensive application of the shelterwood system over large units is unfavorable for Eso spruce. Although the seeds germinate, the seedlings do not attain good development under the shelterwood and finally die; further, the overwood is exposed to storm danger.

The border-cutting system does not meet the requirements since the reproduction becomes established too slowly.

The following considerations are involved in the application of the method of clear-cut strips with regeneration from the side:

1. Regeneration is most favored if cutting is carried out from north to south.

2. The width of the clear-cut strip may in most cases be half the height of the stand; with a greater width reproduction does not develop as well.

3. The regeneration strip should be established by means of a single cutting.

4. The length of the cutting strip has no great importance for the regeneration; however, it is better if the strip is established in a straight line and does not extend out for a distance of over three times the height of the stand.

5. The regeneration strip should be freed of weeds and litter and the soil covering should be lightly grubbed up prior to the cutting.

6. In case artificial sowing of seed is necessary, 6 grams of seed are sufficient for a square meter.

7. After the young growth appears on the cut-over area, over-topping weeds should be cut at least once during the summer.

8. Approximately five years after the first cutting, when the young growth becomes capable of developing without further protection, and a seed year is in prospect, the second strip cutting should be made if possible in the winter. By this means establishment of reproduction tends to be continuous.

9. It is well to fill by planting any gaps which occur in the regeneration strip within the five years.

The text is written in Japanese so is unavailable so far as the reviewer is concerned. However, the general appearance of this rather large volume is excellent. It is accompanied by a list of 92 references in German and English.

H. J. Lutz.

Etwas über Forstpflanzenzüchtung. (The breeding of forest trees.) By F. v. Lochow. *Der Züchter 1: 73-79. 1929.*

Writing in this journal of theoretical and applied genetics, published for the Society for the Promotion of German Plant Breeding and the Kaiser Wilhelm Institute for the Promotion of Breeding, the author describes some experiments on forest-tree breeding and seed selection which have been in progress for some years at Petkus, Germany.

In one simple experiment seed crops were harvested separately from individual trees on the west border of a stand of mature Scotch pine (*Pinus sylvestris*) and from individuals within the stand, the trees on the west border being adjacent to a stand of younger trees grown from seed from another locality. The progenies from the several mother trees were then compared in the nursery. Such studies indicate that this species may be subdivided into several geographical races so distinct that the trees of the several races often fail when planted in unsuitable localities. The author states that trees produced in Germany from seeds raised in southern France are much inferior to those grown from east Prussian seed, and calls attention to the disastrous results that have followed the use in Germany, during the past 50 years, of unsuitable seed. He surmises that the reason for the poor performance is probably to be found in a relatively poor resistance to frost and drought.

He then describes selection experiments which were begun seven years ago. In this work, superior trees in the stand were permanently numbered and the seed crops harvested from them individually from year to year. The seeds from each tree are planted by themselves in an experimental nursery, in the later work with provision for leaving one or two individual trees from each lot to grow to cutting size. Recently, also, frequent plots of seedlings from one especially good tree have been interspersed among those from the other trees which are being studied. It has been learned that the seeds of different years' crops from any one tree are quite uniform in color and weight, but that those from different trees vary greatly in both respects. The young trees, also, show marked differences in growth, development, and needle color.

Most of these experiments have been conducted with seed from a 70 to 80-year-old stand, but in addition in some of the work seed was used from a 180-year-old stand in an adjoining district, and also from individual trees. The author calls attention to the great advantages, as compared with grain breeding, for instance, of having the mother trees remain alive year after year.

He also has a suggestion for crossing the more desirable strains by a method considerably simpler than those used at the Eddy Tree Breeding Institute.[1] This

[1] Austin, Lloyd. A new enterprise in forest tree breeding. Jour. For. 25: 928-953. 1927.
———. Breeding pines for more rapid growth. Jour. of Heredity 19: 287-301. 1928.
———. The Eddy Tree Breeding Station. Madroño 1: 203-227. 1929.

consists in establishing in the midst of open fields a pine stand made up of wide-spaced progeny from the selected trees and surrounded by a screen of Douglas fir. By cultivating and fertilizing and breaking the tops back early seed production on bushy plants ought to result, so that the first generation after the crossing would perhaps be available in 25 or 30 years.

The author touches briefly upon artificial fertilization and upon breeding for quality, the former of which is being highly developed at the Eddy Tree Breeding Station, while the latter is considered of lesser importance at the present time. It is planned to extend the experiments at Petkus to Douglas fir and larch.

In conclusion, the author requests information about studies of forest tree selection and breeding which are being made in other parts of the world.

This paper contains a number of interesting observations and suggestions and further attests to the current interest in the subject of forest tree breeding which has been given prominence by a number of papers published in the JOURNAL OF FORESTRY in recent years. It is well illustrated from a number of photographs including several showing the differences in growth between progenies from different mother trees.

FERDINAND W. HAASIS.

Annual Report of the Director of Forestry of the Philippine Islands for the Fiscal Year Ending December 31, 1927. *Manila, Bureau of Printing, 1928. Pp. 263.*

This report covers in detail the work of the Philippine Bureau of Forestry, carried on under the Divisions of Investigation, Sawmills and Utilization, Forest Products, Forest Lands and Maps, Licenses, Administration, and Forest Management. The organization of the Bureau follows that of the United States Forest Service. Its personnel consists of a permanent force of 337 and a temporary force of 172 which appears to be inadequate to cope with increasing activities divided as they are into all phases of forestry work.

Besides having supervision of the forests and carrying on the details of the various divisions, the Bureau administers a school of forestry, regulates the licensing of fish and game, attends to the registration of private woodlands to avoid fraudulent exploitation of the forests, coöperates with individuals, schools, municipalities, government bureaus, and corporations in forestry extension work, and grants caiñgin (agricultural) permits. A great amount of timber is destroyed annually through illegal caiñgin. In 1927 there were 2,002 cases of this type wherein 4,609 acres of land were cleared and 3,163,716 feet of timber destroyed. In an endeavor to avoid such destruction of timber these caiñgin permits are granted, yet violations continue because of an inadequate force of officers to patrol the forests.

The area retained for forest purposes as timberlands is listed in 1,143 blocks totaling 1,096,559.63 hectares, or 2,709,598.85 acres, of which 467,712.8 acres were delimited as timberland in 1927. From these public forest lands 50 mills cut 404,969,000 board feet of lumber in 1927. Exports of this material consisted of 72,034,632 board feet of which approximately 54 per cent was shipped to the United States, 25 per cent to Japan,

6.6 per cent to the United Kingdom, 6.2 per cent to China, 5.2 per cent to Australia, and the remaining 3 per cent to 11 other countries.

In minor forest products utilization activities were settling around a proposed 500,000 pesos cutch factory for using the bark of the mangrove and its wood destructively distilled for acetate of lime, wood alcohol, and tar. Also a 500,000 pesos pulp and paper factory corporation was being organized.

Stress was laid by the Bureau during the year on land classification, in which 117 members of the personnel were employed. Since 1920 when this work was initiated there have been 1,054 projects with 20,368,4441.37 acres classified with a per acre initial cost of .0129+ pesos to that of .003+ pesos in 1927. Of this large area 2,515,302.05 acres involving 223 projects were certified to during 1927 as 467,712.81 acres timberland and 2,047,589.24 acres alienable and disposable. From 1920 to 1927 it has been necessary to reclassify only 16,819.58 acres of these tracts and alienate them, and to reëxamine 1,366.96 acres formerly alienated and revert them back as timberlands, which shows how thoroughly the classification of the lands has been carried out.

Although progress has been made in reconnaissance, timber estimating, growth studies, working plans, and dendrology, the work along these lines was limited since the personnel of the Division of Investigation was largely used for instruction in the School of Forestry. Durability tests of American woods with creosote and of Philippine woods with various preservatives are being carried on.

For the year 1927 the Bureau received a total of 691,534 pesos in appropriations made by the Philippine government with an addition of 50,000 pesos as a special appropriation covering reforestation work that is available annually until spent. There is also a fiduciary fund carried by the Bureau consisting of bond deposits from timber and forest products licensing and a concession trust fund that is used in paying those forest guards whose salaries are paid by the lumbermen in accordance with the terms of the licenses. Receipts for the year amounted to 1,533,057.12 pesos which shows the Bureau is on an excellent paying basis.

In summing up the needed changes for the Bureau the Director submits a number of recommendations which may be briefly stated as follows:

Provide funds for additional personnel to cope with increasing activities and to give deserving men increased promotion.

Adopt legislation to:

Permit increase of pasture areas.

Permit increase of residence areas.

Prohibit declaration of forest lands as private property and enjoin assessors to refuse such declarations under conditions.

Permit increase of penalties from twice to ten times regular forest charges.

Permit increased control in handling game and fish.

Permit increase of all forest charges.

Greater number of forest stations necessary.

Road repairs needed.

Provide laboratory facilities in Divisions of Investigation and Forest Products.

E. O. Siecke.

Cellulose. A monthly journal devoted to scientific and technological research and progress in cellulose. *Cellulose Publishing Co., 114 East 32nd Street, New York City. $3.00 a year. Announcement issue, dated February 1930.*

The new journal, "Cellulose," is a welcome and timely addition to the technical periodical press. It might seem that we are oversupplied with technical periodicals, but when one considers that cellulose is already a very enchanting field for research and investigation, that the literature upon it is growing very rapidly, and that interest in its possibilities is extending outside the research laboratories, the appearance of the new journal seems quite in order. On the other hand, unless it maintains a high standard of technical editorship and of usefulness, it would hardly be worth while in view of the other journals devoted to industrial chemistry.

The publication will find a friendly reception among foresters, particularly those who are so enthusiastic about cellulose as a possible creator of profitable forest practice. The publishers, on the front cover, refer to cellulose as "the world's most abundant and responsive base-material." Unfortunately for the forester, cellulose is *too* abundant. It can be readily supplied by so many plant materials—cotton, cornstalk, bagasse, bamboo, hay, and many others—that it is not at all certain that the industries requiring it will have to go to the forest for it.

The articles in this first issue are general and technical. In the leading article, "Is There One and Only One Cellulose," Louis E. Wise of the New York State College of Forestry discusses the identity or lack of it of the cellulose from various plant fibers. The second article is a posthumous contribution from the facile pen of E. E. Slosson, under the title "Do We Need Trees?" After giving voice to his offended sentiment on tree cutting, he says, "But I will weep no more over our vanishing forests, since reading an article under the startling title 'Why Sawlogs?' by Alfred Gaskill." George Rommel, in "The Farmer and Cellulose," gives as an important deterrent to the utilization of various farm cellulose crops their cost of harvesting. There is in this article a hint to foresters that even if cellulose does become the dominant purpose of growing trees, it will always enter a buyer's market, so from this angle, forestry would be no better off than it is now in the growing of lumber. C. P. Winslow, Director of the Forest Products Laboratory, has an article "Looking Forward to Better Utilization," in which he calls attention to our utilization of such a small part of the tree. Two graduate students of the New York State College of Forestry, Messrs. Kang and Libby, publish a thesis on the chlorination of birch wood pulp. Other articles include "The Dyeing of Viscose," "Sunshine in Tangible Form," "Cellulose Nitrate Coated Viscose," "Cellulose," and "The Electrodeposition of Cellulose."

In his article on "Cellulose," Dr. Reid of Johns Hopkins says the achievements in cellulose, though splendid, have awakened desires rather than satisfied them. "For ages wood and stone have been the materials of which man has built his abodes and fashioned his furni-

ture. Both are lacking in plasticity; both must be shaped by cutting away part of the material. . . . . Complicated structures of wood are possible only by the use of glue, nails, and screws. The losses of material in wood working are enormous; . . . ." The author looks, evidently, to researches in plastic cellulose to make it more amenable to treatment and for use for whatever is now made of wood.

Not the least important, and a department that will give strength to the new journal, is the section on "Technical Abstracts" in which current literature on cellulose is abstracted.

The writer likes the name of the new magazine, "Cellulose," but wonders if "Journal of Cellulose" would not have been more appropriate. The present name will make reference to the magazine awkward at times, as was indeed found to be the case in the preparation of this brief review.

The forestry profession will surely welcome "Cellulose" and wish it a maximum of usefulness.

EMANUEL FRITZ.

NOTES

Policy and Legislation

1. Timber forestry on a grand scale cannot be secured for the United States, unless there be a radical change in policy, and unless timber forestry is sure to be, in consequence of such policy, a very remunerative investment, a very safe investment, and also a very handy investment. A handy investment is, like stocks in exchange, easy to buy and easy to sell.

2. Conservation of natural resources privately held is impossible unless conservation thereof is more remunerative than is destruction thereof. This fact is generally neglected. Roosevelt and Pinchot, in advocating conservation, have failed to tell the people of the United States that conservation is usually less remunerative for the owner than is exhaustion and destruction, and that the people must pay for the difference if they want to have any conservation of any resource. All American foresters have made the mistake originally committed by Roosevelt and Pinchot.

3. A common carrier working under a public charter can be legally compelled, under the terms of its charter and under the laws of the land, to do what it does not suit it to do. Owners of timberlands, of farm woodlots, and of any other private property, however, cannot be thus compelled. This legal rule will apply, also, to such forest properties as were acquired in the past by a predecessor in title through actual fraud.

4. What assurance do we have that timber will be actually needed for any purpose in the year 2000? For houses—none! For railroad ties and railroad cars and telephone poles—none! For furniture—none! And so it is with all other uses except paper, the production of which requires no more than 4 per cent of our forest area. Faced by this situation, who can dare compel an owner to raise timber fit for use in the year 2000?

5. True, timber will be used in preference to its substitutes as long as timber is cheaper than the substitutes. Unfortunately, it *cannot* be cheaper without reducing the *present* cost of production (of second growth), the main components of which are:

a. Rate of interest on capital invested.
b. Taxes.
c. Fire protection.

Of these three factors the first is by far the most important. At 2 per cent, a capital doubles in 36 years; at 8 per cent, it doubles in 9 years and octuples in 36 years. If the rate of interest charged against forestry were 2 per cent, taxes and fire protection would not tend to make the cost of production insane. Indeed, with money obtainable at 2 per cent for timber forestry Fairchild's tax problem, too, would be solved automatically.

6. Cheap money—as cheap as the money loaned by the people to national banks—cannot be secured by prospective investors in timber forestry unless it be advanced to them by the people.

7. The people, in advancing cheap money to owners of forests pledged to forestry, be they lumbermen or be they farmers, may make the loans required under well-considered charters (analogous to those issued for national banks). A charter protects the people's interest *together with the owner's interest.* There is no other legal way for joint coöperation to a common end between people and owner.

Would there have been any transcontinental railroads *without* the alluring charters granted to the enterprisers?

Would any national banks have been established when we needed them and when a radical change was required *without* charters increasing their profits?

Would there have been any rapid development of our American industries *without* the alluring prospect of import duties amounting to charters and favorable to the enterprisers?

CONCLUSION

I have been in the game of American forestry for 35 years; I am thoroughly convinced that there will not be any American timber forestry on private lands unless there be radical changes in American forest policy. We cannot have any timber forestry *permanently* established unless it be obtained under charters. The charter must safeguard the investors' financial demands; the charter must safeguard the people's economic demands. The people themselves are interested in *cheap* timber, and cheap timber cannot be secured unless money is cheap.

There is no sense in ephemeral attempts at timber forestry. I had charge myself of such an attempt from 1896 to 1909. Whimsical fluctuations of desires with the owners, division of property among heirs, and, indeed, financial failure of the owners will always destroy whatever timber forestry might have been established, *unless it be under national charters.*

The more favorable the terms, the more rapid will be the development of American timber forestry. The first condition, however, which the charter must secure for the owner is cheap money.

C. A. SCHENCK.

SOME POINTS TO BE CONSIDERED IN FRAMING A FOREST POLICY FOR THE SOCIETY OF AMERICAN FORESTERS

1. The Society of American Foresters is a body of professionally trained foresters employed in all the various fields of forest activity. Some are in public service working for the public welfare; some are in private employ serving the interest of the private owner; others are engaged in the educational field, in the training of men to qualify both for public and for private service. Any forest policy, therefore, which the Society of American Foresters may adopt must have due regard for the public welfare and for private interest in their proper relationship.

2. The public welfare demands that forests be maintained wherever they are needed: (a) to insure an adequate timber supply; (b) to protect watersheds and prevent erosion; (c) to serve recreational needs.

3. Private interest requires such management, use, and disposal of forest property as will yield to the private owner

concerned the best return on his investment.

4. The public welfare and private interest do not always coincide. Oftentimes private interest requires a system of management and use which leads to forest destruction on lands where public welfare demands forest perpetuation. With equal frequency the public's neglect of its duty creates a condition which forces destructive exploitation and abandonment of forest land which otherwise could be profitably devoted to commercial timber growing.

5. Wherever public welfare and private interest conflict, the public welfare is paramount, and the public has the right to exercise such control over the management and use of private forest property as will insure the protection of its interests. Simultaneously it owes a duty to the private owner to eliminate those obstacles created by itself which prevent the practice of commercial forestry, viz., excessive fire risk and unfair taxation. The public has an additional responsibility to aid in overcoming the present ignorance concerning right forest practice, through aggressive support of a comprehensive program of research.

6. The private forest owner is a part of the general public, and the public welfare is his welfare. In those cases where the public welfare demands preservation of a proper forest cover on his lands, he may also be serving his own private interest by management of his property toward that end. Conversely, the general public is made up of a vast number of private individuals the sum total of whose individual private welfare and interest goes to make up the public welfare. It has been estimated that the forest industries of the country contribute directly, and indirectly, to the support of nearly one tenth of the population. The products of the forest industries serve the needs, directly and indirectly, of the whole population. The prosperity of the forest industries, and their ability to supply their products in sustained quantity and at economical prices, is closely inter-knit with the general public welfare.

Any national forest policy which proposes public regulatory control of private forest properties must take these factors fully into account.

7. The coöperative and research activities already provided for under the Clarke-McNary, and McSweeney-McNary Acts, and in complementary state legislation, must be pushed to full fruition with the least possible loss of time in order to eliminate the three principal man-made obstacles to profitable commercial forestry, viz., (a) excessive cost of protection, (b) improper methods of taxation, (c) ignorance concerning correct forestry practice.

8. Public forest ownership must be greatly expanded. To date less than one fifth of the total forest area is so held. Large additional areas are primarily valuable for watershed and to some extent for recreational purposes. Such public values can be properly conserved only by a modification of ordinary commercial forestry practices and at an increased cost which private capital cannot and should not be required to bear. Forests of this class logically belong in public ownership.

There are other large areas, in various parts of the country, of submarginal forest lands which have too low a productive capacity to be profitable in private ownership. Such lands to the extent required by the public's ascertained needs for

future timber supply should be converted to public ownership and managed accordingly.

While there is practically unanimous opinion that public forest ownership should be greatly expanded, nevertheless there is divergence of opinion as to details—just what lands should be taken over by the public, and whether the ownership should be federal, state, or otherwise. There is needed a nation-wide, comprehensive program of public forest acquisition, coördinating clearly the federal, state, county, and municipal responsibilities, and defining the classes of land and the particular areas to be acquired.

9. There is pressing need for a workable plan for stabilizing the lumber industry in order to conserve the remaining supply of virgin timber from the rapid, unprofitable, and wasteful exploitation to which it is now subjected, and to remove the deadening influence which the present situation imposes upon the spread of improved forest practices.

This problem is of such seriousness, magnitude, and complexity as to require in its solution the best thought available. It is of intimate concern to the forestry profession whose members can and must play an influential part in developing and executing a plan of action that will produce the desired results.

10. The public's right to control, or regulate, the use of private forest property should be exercised when and where the evidence is clear that public welfare specifically requires such action. The application of public control should not precede the fulfilment of the public duty to remove those man-made obstacles which prevent profitable commercial forestry.

F. W. Reed.

"We Cannot See the Forest for the Trees"

Probably no human being has a perfectly balanced conception of such a broad field as forestry practice. Foresters have been forced to get a toehold as best they might. One finds a niche here, another there. Thus each is encouraged to see the whole from some side which gives an emphasis to specialties, partial conceptions, narrow or extreme views.

We need a better conception of what it is all about, and particularly of what is involved in actual forestry practice in connection with the forest itself, considering changing economic conditions, contacts with other business, and the conflicting or harmonizing needs of consumers. Times change slowly or rapidly (as at present), but fundamentals are always with us.

The past experience of nations is not an infallible guide to the future, though it is a conservative indicator. We should live in the present with a knowledge of the past.

Let us face the fact that substitutes are now decreasing lumber requirements along certain lines. In some cases the substitutes are better, or better and cheaper as well. Much timber can be imported from the tropics and elsewhere to help tide us over a considerable period of shortage. We shall gain if we encourage the use of those forest products which can be harvested now without harm to the output or quality of our forests in the future.

We should realize, also, that the keenest demand of the future may be for wood fibre rather than lumber. However, it is hardly conceivable than any time will come when it will be impossible to use to advantage a large volume of

lumber of the right kinds and sizes and at competitive prices. Much fibre can be grown as annual or short-term agricultural crops, but such raw material cannot drowd forest products out of the market to any large extent. Even in a most extreme case, a considerable amount of wood will grow without attention on abandoned lands where no money must be returned for stumpage and where the cost of collecting at factories will not exceed the cost of growing an agricultural crop. The present population will not eliminate forest land from the earth. The sensible and businesslike plan is to encourage forest growth upon this land for the benefit of mankind.

We must realize, too, that today there are large areas of timberland whose most valuable product is recreation, fur, or game. These products are often donated by the owner to the public, although there is a rapidly increasing trend toward posting lands. These and others are forest products whenever they depend upon forest lands for a large part or all of their volume, or part or all of their value.

The value of recreational waters is tied up closely with forests, and has increased so enormously in some sections as to make the market value of woody growth an incidental item only.

We know definitely which are the less desirable or "weed tree" species of today, but we do not know that they will be so considered 20 years from today. Probably the worst we can expect is a temporary oversupply of such timber. We may be sure that if such an oversupply exists in any favorable location, the consequent low price at no distant date will cause it to be used for some useful purpose, perhaps as fibre or raw material for chemical processes.

Let us banish our fears that our forest products will not be earnestly needed, and consider a definite forest area under proper management. Such management involves at least an effective degree of protection, insurance of reproduction, removal of timber proper to remove, and restoration of blank areas to a productive condition. The products may be many such as sawlogs, wood, recreation, ferns, beaver pelts, etc. With a balanced budget, the average annual production pays the average annual costs and such additional profit as the management may be able to effect wisely. Probably any year's production will come from limited areas and part of the costs occur on other areas. But the property must be considered as a whole as in any similar business. In almost every business, there are departments which are not directly profitable, others which are under development, and those which constitute an undesirable but unavoidable burden on the whole. Obviously, the same is true of most forests even under most efficient management.

This same inclusive management should be applied to the forest land of the country as a whole, but not by any one agency. The federal government cannot be expected to take over the entire forest land area of the country and place it under good management within a reasonable period of time, nor do we desire that it should, for management is a field in which it functions poorly. But it can assist in securing good results quickly and at small cost through regulation, a field in which it functions fairly well. Suitable and basic regulation must come through the government, as no other

agency is broad enough to cover the ground adequately.

Now what is the upshot of the problem? We have a vast area which may be considered as forest land because it has no immediate use for more important purposes (if you persist in putting forest land in such a low position as if ashamed to have it exist at all). Every acre is owned by some agency either public or private. Every acre in private ownership will so continue or it will revert to public ownership. We may therefore consider that every acre is under responsible ownership. Obviously, it is to the interest of the owner and also the general public that each acre produce as much as it can be encouraged to do along natural lines, whether the product be scenery, furs, water control, lumber, wood fibre, or what not. To encourage such production along lines of both quality and quantity is the province of forestry.

I do not see that we should attempt the unnatural, or work mainly for one certain valuable product where some other product is the natural one, or insist upon one product paying all costs where nature favors various other products growing along with that one which may interest us more keenly for the time being. It strikes me that if each area is put to its best natural use to produce the greatest amount of those assets which nature favors on that area, the costs of production will be the lowest and the future will have a use for the various products in one form or another. When we favor certain species, we should not do so to the extent of destroying the natural balance. As I see it, the problem is to maintain a long view ahead and do now those more or less obvious things which can be done sensibly and profitably, to utilize to the best advantage those products which can be harvested now to the profit and health of the forest, and to assist nature to improve and grow for the advantage of humanity.

There is in sight enough work plainly needing to be done to keep all foresters busy. Why cannot the owners see the truth? After the first obvious steps have been taken, the next logical steps will appear just as plainly. The question is not whether something should be done or nothing at all. Nobody can afford to hold a property which is producing nothing, and it is plainly to the interest of the holder, whether a public or a private agency, to increase production in quantity or quality or both. It may not be financially feasible to do everything desirable at once, but there is always something, even if small, which can be done now on a good business basis. As a rule, that something is not being done.

H. V. Bailey.

"Technical Men," "Practical Men," and—Dubs

When I hear any serious allusion to the threadbare controversy anent the relative merits of "technical" and "practical" men in the actual practice of forestry, my bristles start to rise—and this altogether regardless of whether the speaker, or writer, takes the one side of the question or the other. This is because about nine times in ten the speaker, in my opinion, evinces such a degree of intolerance or downright ignorance as to wholly incapacitate him from forming an equitable judgment of the merits of the other class.

If the one who has the floor happens to be of the "rough-neck" strain he is all too apt to leave us the impression that he, as a "practical" man, figures that anyone guilty of having secured a college degree in forestry is thereby, and inevitably, a visionary and a dreamer who "kaint do nawthin" in the woods. On the other hand if the speaker pretends to special educational advantages which place him in the category with "technical" men, and especially if he is of the natural-born, pin-head type, or is at a certain stage of callow inexperience, he is likely to advance the argument that anyone who has not attended a forest school, taken the requisite number of hours of study, and copped off a degree, cannot by any possibility know anything about the subject, or do anything worth while without a technical man looking down his collar.

Fortunately, but few of the young school men are naturally so narrow between the eyes that they do not lose most or all of this intolerance in direct ratio with experience gained; the "practical" men are usually older and inclined to be, in my experience, more "sot in their ways" and more tenacious of their prejudices. Such an intolerant attitude is a unmitigated evil and carries a stinger at both ends. An argument between the proponents of the two sides of the question would not get either one to first base in a thousand years. Both are wrong—dead wrong.

Occasionally there is a "practical" man, *i. e.*, one who perhaps gained his first lessons in forestry on the end of a crosscut saw and solely by exercise of his faculty of observation, who comes to realize that there was an immense amount of worth-while knowledge, gleaned by a long line of thinkers before him, which for one reason or another he failed to get while the getting was good—and dad or some one else paid for it! Then, by the spark of the love of knowledge in him, he opens the door of his mind and allows that spark to be fanned into flame; refuses to admit that the gates of learning are closed to him merely because he is no longer a beardless boy and must now perforce pay the freight himself; and seizes upon all useful knowledge as his right.

Slowly at first, and with labor, he fits the familiar 2 of practice to the less familiar 2 of theory and finds he has a symmetrical 4. He must, in a manner of speaking, work backwards at first; from the results with which he is acquainted through observation, back to the unfamiliar realm of theory in search of the "why" underlying the observed result. He finds the search fascinating; he discovers also that there is nothing mysterious or supernatural about taking a theory and working *upward* with it to its logical result; and he realizes the value of this newly acquired power. If he started out burdened with a prejudice against men who perforce came up from the theoretical end of the trail, he loses this and meets the younger ones with tolerance for their lack of experience (time cures that), and with recognition that they are already equipped to follow rapidly the trail over which he groped; while the seniors he meets as fellows.

Such a man is likely to realize that knowledge is free to those who *will* to take it, and he may prove of value and go quite a way before night overtakes him.

Occasionally there is a man who graduates from a forestry course and comes into the woods raw and largely devoid of practical woods knowledge. But this man is endowed with the requisite I. Q. Also he has the good sense to realize that his college degree really means little more than that he has, at some one's expense, been furnished a good kit of tools with which to work, and that if they are not used they will surely rust. Moreover, he has those qualities of mind and character which both enable and impel him to seek for, recognize, and acquire useful knowledge, and to acknowledge the source from which obtained. Thus he shows due deference and respect for the older "practical" men with whom he comes in contact and rapidly avails himself of practical knowledge which it has taken the older man long years to acquire.

This man may go as far as he likes. I have known many of the type and in every instance been the gainer by the contact. Each can "speak the language" of the other. Speaking roughly, one has started with results and laboriously back-tracked down to the theoretical roots of the matter; while the other has started with the theory and followed out to proven conclusions. One is a *scientific* practical man and the other is a *practical* scientific man, and the education and equipment of neither is complete until they have attained this grade.

A dub is, well—just a dub. He may be an ignorant dub or an educated dub. But a dub's a dub "for a' that and a' that," as Bobbie Burns might have said had he been speaking of Dubs.

WALTER J. PERRY.

ROUGH-NECK FORESTERS[1]

There is a very peculiar feeling among young foresters that they must be "rough-necks" to be accepted into the forestry profession. Nothing is further from the truth. In camp, whether in school or after graduation, these men seem to think it necessary to be rough in their actions, in their language, in cleanliness, and in their speech. Why does a forester think he has to be tough? Does a real lumberjack try to give the impression that he is tough? Does not the modern lumberjack hasten back from his work at the close of the day, hurry through a bath, put on clean clothes before he sits down to dinner?

The author has noted for some years among young foresters a tendency toward "toughness"; so much so, in fact, that the man who is thrown with them and who tries to be a gentleman is almost ostracized. In Europe, forestry is an honored profession and a forester is looked up to; in America, the opposite is almost true. There was a time in America when the logging camp was a rough-and-tumble organization; but even the early days of the one-room cabin, the deacon's seat, the work from sunrise to sunset, and the coarse food did not call for greater "toughness" on the part of the men.

Forestry does not want dudes but it does want men who can at least be genteel in their conduct in camp and outside. A man can wear old clothes and still look neat. He can use profanity, but he does not have to be foul; he can use liquor as much as he wants, but he need not impose his boisterous and silly behavior

[1] From the University of California Forester's News Letter, Dec. 18, 1929.

upon his companions; he can get very dirty and grimy and sticky in the course of a hot day on a dusty road or among charred logs, but there is no excuse for his remaining that way until it is time to retire.

This is not a diatribe against wearing old clothes, letting one's beard grow, or getting dirty, but it is an appeal to foresters in general to teach the rough-neck that he has selected the wrong profession.

EMANUEL FRITZ.

SOUTHERN WEST VIRGINIA FOREST FIRE PROTECTIVE ASSOCIATION [1]

Prior to 1916, uncontrolled forest fires were prevalent throughout the southern section of West Virginia. This destructive process finally aroused forest landowners to the necessity for control measures, and on April 22, 1916, a conference was held, which resulted in the formation of the Southern West Virginia Fire Protective Association. The total acreage turned in by the committee at the first meeting consisted of 97,000 acres, sparsely scattered through an area consisting of approximately 2,600,000 acres. This made it necessary to protect large areas which had not come into the Association, obviously an unfair arrangement. Accordingly, in 1925, the West Virginia legislature passed a law making it compulsory for all landowners to protect their forest lands—or all lands not in grass or cultivation—and to pay the state or one of its affiliated associations 1 cent per acre for this protection. This built up the Association by increasing its area from 610,427 acres on January 1, 1924, to approximately 1,300,000 acres on January 1, 1929, so that it is now one of the largest associations of its kind in the United States and the largest east of the Rocky Mountains.

The Association utilizes all its funds for fire suppression and office expenditures, none of the executives receiving any salary for their leadership. Any balance is used to replace old towers and to buy equipment.

The area covered by the Association is divided into two districts lying north and south of the Guyandot Range, each of which is in charge of a district ranger. This ranger's duty, when not on actual fire suppression, is out in his district educating the people through lectures in schools, seeing that necessary posters and fire warnings are placed, and building and perfecting his organization and the perfecting of same. These men are the only ones that receive a yearly salary. The tower observers and fire wardens are employed only during the spring and fall fire seasons.

Each district is divided into tower areas, consisting of from 40,000 to 150,000 acres. The towers are so located that every acre of their particular area is under observation and have the usual equipment of telephones, binoculars, maps, and alidades. The rangers are supplied with special fire fighting tools, including a pump which can be handled by two men and can extinguish a quarter of a mile of fire without refilling. Considering the much higher rate of pay in most lines of work outside the service, the Association has been very fortunate

[1] From a paper presented at the West Virginia Commercial Forestry Conference, Charleston, W. Va., Dec. 4, 1929.

so far in obtaining, in most cases, a very good type of men for ranger and observer work. The local wardens are selected from men of good standing in their communities, and each has from 700 to 1500 acres of land to patrol.

The state police are also a very valuable asset to the Association, as they render valuable assistance by helping suppress fires and by apprehending fire setters and persons refusing to fight fire. They are put through a special course in this work and can always be counted upon to give intelligent service.

Forestry will not succeed until we can have complete fire protection on all private lands. This may be an ideal beyond the possibility of present achievement, but the Southern West Virginia Forest Fire Protective Association challenges any other similar association of private land owners to show more interest in this important subject than does this Association.

GEORGE E. BROOKS,
Secretary.

REFORESTATION ON THE MONONGAHELA NATIONAL FOREST[1]

There are approximately 40,000 acres on the Monongahela National Forest in need of planting, with at least an equal area of adjoining private land in the same condition. To plant this area and similar lands on other eastern national forests a nursery has been established by the U. S. Forest Service at Parsons, W. Va., with an annual output of about 2,500,000 trees. These will consist chiefly of red spruce for the Monongahela Forest, with white spruce, white pine, red pine, and Japanese larch for other eastern forests. A small amount of hardwoods, such as black cherry, white ash, black locust, and yellow poplar, will be raised for experimental purposes. The trees will be chiefly 2-1 transplants, with some 2-0 white pine and red pine.

It is planned to plant each year about 1000 acres on the Monongahela Forest, 1000 acres on the Allegheny Forest in Pennsylvania, and small areas on other eastern national forests. To meet this program the nursery consists of 28 acres, which is sufficient to provide for crop rotation, building sites, drives, walks, and landscaping.

We have found that women are the best nursery labor for weeding, threading, and sorting. Much of the nursery work is accomplished during early spring or late fall when the weather conditions are rather disagreeable. Rest rooms for both the women and men have been found necessary, and a building with sanitary facilities, lockers, a smoke room for men, and a lunch room for women has been provided.

Water for the nursery comes from the Blackwater River where it is pumped into a 5500-gallon tank supported on a 30-foot steel tower, and from a 60-foot well where it is pumped by an automatic Myers pump into a 1500-gallon pressure tank. Sprinkling is accomplished by a portable adaptation of the Skinner sprinkling system known commercially as the March rainmaker.

All of the best known labor saving devices are used, including a mechanical seeder, a mechanical soil spreader and

[1] From a paper presented at the West Virginia Commercial Forestry Conference, Charleston, W. Va., Dec. 5, 1929.

sprinkler, Yale and Schrader transplant boards, and the Savenac threading shelter.

The fertility of the soil is maintained by a system of crop rotation. It is planned to use an area in transplants once every three years. The seed beds are fertilized at the time of sowing with a fertilizer containing ammonium sulfate, acid phosphate, and muriate of potash.

On the Monongahela Forest the principal species planted is native red spruce, with a spacing of 6 by 6 feet, or approximately 1210 trees to the acre. Others species are being planted for experimental purposes, such as white pine, red pine, southern balsam fir for Christmas trees, and Japanese and European larch for pole material to take the place of blight-killed chestnut. Small amounts of black cherry, white ash, black walnut, and yellow poplar are being experimented with in mixtures. It is believed that the best mixture will be composed of red spruce, white ash, and black cherry.

From the meagre data available as to red spruce in West Virginia and elsewhere under natural conditions, it may be assumed that the plantations will reach a size merchantable for pulpwood in about 40 years. It is impossible to hazard a guess as to yield at this age, but it is probable that the planted trees will produce pulpwood at an average rate of at least $\frac{1}{2}$ cord per acre per year. On the old Dobbin operation, situated east of Davis on the Allegheny Mountain, 25,000 acres averaged 22,000 board feet per acre of red spruce pulpwood, and on one acre the cut of pulpwood ran up to 104,000 board feet per acre.

It is even more difficult to predict what spruce pulpwood will be worth on the stump 40 years from now. Present prices in various spruce regions of the country range from $1.50 to $6.00 per cord. It is possible that there will be considerable increase in value over a period of 40 years.

The cost of field planting on the Monongahela Forest has run from $8.00 to $9.00 per acre. Nursery stock has cost from $5.25 to $22.00 per acre. The latter figure was due to moving a small amount of stock from the old Gladwin nursery, where costs were high. The objective is to cut nursery costs to below $5.00 per thousand and planting to $7.00 or $8.00 per acre, making a total cost of not over $12.00 to $14.00 per acre.

It is believed that in addition to the indirect benefits from increased watershed protection, recreation, and the putting of idle land to work, spruce plantations on the Monongahela National Forest will in the long run repay all investments made by the government plus a reasonable rate of compound interest, and also that the returns to the local political unit will equal or exceed the returns which might be expected from taxation of private land.

C. L. Perkins.

Successful Use of Woods-Lifted Seedlings of Southern Balsam

The general practice in discussing woods-lifted seedlings is to dismiss the subject with dogmatic statements, using such generalities as, " It costs more than nursery-grown stock; it has a lower survival per cent." Admitting the general truth of such statements, it may be well not to dismiss the possibility that woods-lifted stock may be highly successful in

some instances and compare favorably in cost with nursery-grown stock.

The area under discussion is the Mount Mitchell State Park in Yancey County, North Carolina. The park is under the direct control of the North Carolina Department of Conservation and Development, has an area of 1,224 acres, and lies entirely above an elevation of 5,800 feet. The primary consideration in the planting of the slopes badly burned in 1916 and earlier was to get them covered with coniferous trees as soon as funds were available; thus the spacing decided upon was approximately 8 by 8 feet, making about 680 plants to the acre. The natural reproduction was less than one coniferous seedling per acre in 1927, at least eleven years after the fires. Occasional spots of four or five spruce and balsam seedlings were found.

The entire park is in the red spruce southern balsam type. Norway spruce was tried, but did not seem to survive well at the higher elevations. Red spruce (*Picea rubra*) would probably have been the most desirable tree to plant, but it reproduces sparingly under the spruce-balsam type and neither it nor the southern balsam (*Abies fraseri*) could be secured from nurseries. Southern balsam reproduces prolifically under the spruce-balsam type and therefore was the logical tree to use for woods-lifted stock when the practice of woods-lifting seemed the only method available for obtaining native species.

The cost of lifting trees in the woods and placing them in the nursery was $2.20 per thousand based on 13,300 trees. This low cost was due to the condition of the soil and the shallow root system of the balsam. The loss of seedlings and care during the year was negligible. It was found that at this elevation if weeds, chiefly sheep sorrel and moss, were not allowed to remain, the transplants were heaved out of the beds during the winter.

The slit method of planting was used exclusively, and despite the roughness of the terrain the cost was only $6.88 per thousand for the planting. This was using labor costing 25 cents per hour plus subsistence amounting to about 50 cents per day per man. The cost was based on the planting of 16,850 southern balsam during the spring of 1929. The above cost per hour of $6.88 includes lifting from the nursery. The total cost from woods to planting site was $9.08 per thousand trees comparing very favorably with the cost of transplant stock secured from nurseries.

Table 1 shows that the survival was satisfactory except in one instance. The individual trees in the plantations were vigorous and healthy in appearance.

On Plots B and C were trees lifted from the woods and planted directly on the area to be reforested. The trees on the rest of the plots were grown one year in the nursery after being lifted from the woods.

The survival per cent was based on the selection of a row at random in the plot and the counting of blanks and living trees in fifty to a hundred instances. These percentages were roughly checked by walking through the plantation and seeing if there was any appreciable variation from the per cent obtained by count.

The cause of the low percentage of survival in Plot U could not be determined as the writer did not directly supervise this planting.

Measurements on 14 trees in Plot G in 1929 showed them to have made an average growth of 6.3 inches the previous year, and on 12 trees in Plot J in 1928 of 2.1 inches.

No doubt in many cases where seedlings reproduce in large quantities on small areas and under conditions similar to those on Mount Mitchell, the use of woods-lifted stock would be more desirable than stock grown from seed in a nursery. Factors favoring the procedure outlined above are familiar to the forester: climatic adaptability of the stock; trees of suitable size for field planting secured at once or after waiting only one year instead of three or four; and lower cost.

Experiments are now under way to determine whether there is any advantage in even one year in the nursery. The available data, although somewhat meager, seem to indicate that even this refinement is not necessary.

F. H. Claridge.

Seed Yield Data for Southern Pines

In the course of germination and storage tests with seed of the southern pines, the Southern Forest Experiment Station has accumulated certain incidental data concerning the cones and the yields of seed of longleaf, slash, loblolly, and shortleaf pines. These figures are summarized in Table 1, in which the "usual averages" are representative of the values ordinarily occurring. The extremes given parenthetically under the "usual averages" include the minimum and maximum values observed for lots of cones and seed not affected by immaturity, loss of seed before collection, improper extracting technique, or abnormal insect injury.

The values for number of seeds per pound are based on seed from which the wings have been removed except in the case of longleaf pine, the seed of which is not freed of its wings in ordinary practice. With all species, these figures are based on seed from which all impurities,

Table 1

SURVIVAL AND GROWTH OF WOODS-LIFTED SEEDLINGS

Plot	Number of trees	Year planted	Year inspected	Survival in year inspected, Per cent	Average height of 25 trees in year inspected, Inches
B	200 [a]	1923	1929	85	48 [b]
C	300 [a]	1924	1928	95	30
D	1500 [a]	1924	1928	84	12
F	300	1926	1927	96	6
G	480	1926	1928	93	6
H	2200	1926	1928	90	6
J	350	1927	1928	71	6
O	350	1927	1928	98	6
P	200	1927	1928	96	6
U	1000	1928	1929	33	6

[a] No count was kept of these early plantations and the number of trees is estimated.
[b] Averaged 18 inches high when planted.

TABLE 1

SEED YIELD DATA FOR SOUTHERN PINES

Species	Number of clean seeds per lb.[1]	Number of green cones per bu.	Weight per bu. of green cones in lbs.	Yield of seed per bu. of green cones in lbs.[2]	Per cent moisture lost by cones in drying (based on dry wt.)	Per cent weight lost by seed in cleaning (based on clean wt.)	Per cent of seed with kernels (based on total no.)
	Usual averages, with extreme values in parentheses.[3]						
Longleaf pine (*Pinus palustris*)	5,200 (4,010–8,000)	100 (86–118)	34 (28–38)	1.50 (1.00–1.93)	105 (87–115)	....	80 (57–86)
Sonderegger pine (*Pinus sondereggeri*)	13,400 (12,730–14,138)	....	....	....	....	27.8[1]	83[1] .....
Slash pine (*Pinus caribaea*)	15,500 (13,470–19,660)	216[2]	34[2]	1.20 (1.00–1.43)	80[2]	31 (27.4–41.9)	80 (61–85)
Loblolly pine (*Pinus taeda*)	21,300 (17,241–29,264)	500 (393–1,080)	32 (26–35)	1.30 (0.81–1.74)	74 (54–93)	26 (16.0–37.6)	65 (37–77)
Pond pine (*Pinus rigida serotina*)	56,000 (53,230–61,250)	350[1]	31[1]	....	....	....	....
Shortleaf pine (*Pinus echinata*)	69,200 (41,614–84,985)	2,200 (1,444–2,545)	37 (30–42)	1.30 (0.83–1.83)	75 (36–98)	30 (19.5–56.8)	68 (42–83)
Sand pine (*Pinus clausa*)	74,400 (70,280–78,550)	....	....	....	....	53[1]	....
Spruce pine (*Pinus glabra*)	77,500[1]	....	....	....	....	51[1]	....

[1] Wings attached in the case of longleaf; all other species with wings removed. Based on purity per cent of 100.
[2] "Commercially clean"; that is, with wings as in (1), but with purity per cent usually less than 100.
[3] Where number of observations is too small to give much weight, it is shown in parentheses after the average figure.

including aborted or broken seeds, have been eliminated. In other words, the values for number of seeds per pound apply only to weights of seed corrected for purity per cent. The yields of seed per bushel of green cones, on the other hand, are based on "commercially clean" seed containing a varying amount of impurities, and are therefore high.

Although the seed on which these figures are based came from eight to ten different crops and from such widely separated states as Georgia, Florida, Arkansas, and Texas, the data are too meager to permit grouping by geographic regions or climatic cycles. The species are, however, tentatively arranged in the order of number of seeds per pound, beginning with longleaf pine, which still would have the heaviest seed if allowance were made for the wings.

The numbers of seeds per pound are useful particularly in computing total seed requirements and amounts of seed needed per unit area of seed bed. A point of some theoretical interest, however, is the tabular position of the seed of the hybrid Sonderegger pine (*Pinus palustris* x *Pinus taeda*) whose number falls just about midway between those of its two parents.

The green weights of cones are necescarily low, because they have usually been obtained at the extracting plant instead of in the woods. They give, however, a fair approximation of shipping weights, and a means of computing loads on cone storage floors, drying-rack brackets, and extractor-drum axles.

The yields of seed per bushel of green cones, combined with the numbers of seeds per pound, are a guide to cone requirements. Theoretically, they may be combined with the number of cones per bushel to give approximate yields of seeds per cone, a series of figures bearing directly on the problem of what constitutes a good seed tree.

The figures on percentage of moisture lost by the cones in curing, and the percentage of weight lost by the seed during winging and cleaning, are of interest primarily in the development of extraction technique.

The high percentage of empty seeds in ordinary commercial lots, and in experimental lots cleaned as nearly as possible like commercial lots, indicates the primitive state of southern pine seed extraction, and may explain in part the low prices at which the seed is usually sold. It is of interest to note that under ordinary nursery conditions the germination of fresh southern pine seed approaches very closely the percentage of seed containing kernels, and that the stand of seedlings in most southern nurseries is too dense.

Green cones expand from 2.0 to 3.5 times their volume upon opening. Allowance should be made for the maximum expansion. At a minimum, 2 x 4 foot drying racks should have the following depths to carry the expansion of the volumes of green cones indicated:

	Clearance between trays ins.	Volume green cones bu.
Shortleaf	4	.38
Loblolly	6	.50
Slash	6	.75
Longleaf	8	1.0

Of these four species, longleaf pine cones take the longest to open, as might be expected from the structure of the cone and the large amount of water to be removed in drying. Shortleaf cones are most likely to open poorly; some

lots of shortleaf give no trouble, but others are exceedingly stubborn. Longleaf seeds are never more than partially "winged"; of the three other commercially important species slash pine seeds are least difficult to free from their wings, and loblolly usually the most difficult.

Experience at the Southern Station has shown that pine needles are most easily and cheaply removed before the cones open. Once broken and mixed with the extracted seed, the needles are difficult and sometimes impossible to eliminate.

PHILIP C. WAKELEY.

SOME NOTES ON SEED STORAGE

In November, 1910, the writer received a pound of clean seed of the bigtree (*Sequoia gigantea*) from the Sequoia National Forest in California, collected by Ranger W. L. Brown in September of that year. Germination tests at New Haven the following February gave the germination at 62 per cent in 60 days. These tests were conducted in soil on greenhouse benches at a fluctuating temperature from 55° to 80° F.

The seeds not used in the test were placed in a quart Mason jar unsealed and stored on a shelf in the laboratory. The laboratory was heated in winter but not in summer. The temperature of winter storage, therefore, was approximately that of summer.

At six intervals during the past 18 years samples were taken from the jar and germination tests made in soil in the greenhouse. Each test gave a considerable percentage of germination within a test period of 60 days. No subsequent test, however, has given as high germination as the first.

The last test, made on 300 seeds, was in February and March 1929, or 18 years and 4 months after their collection. The following results were obtained on the course of germination:

25 days, 6 per cent
35 days, 13 per cent
45 days, 14 per cent
60 days, 16 per cent

The cutting test made at the end of the germination period of 60 days showed that 24 of the ungerminated seeds, or 8 per cent of the sample, were apparently sound. It appears, therefore, that this particular lot of seed after 18 years and 4 months of open storage under ordinary laboratory conditions germinated 16 per cent in 60 days and had a germination capacity of 24 per cent.

In October, 1928, several quarts of cones of bald cypress (*Taxodium distichum*) from Louisiana were received at New Haven. The cones were collected in early October and immediately shipped to the laboratory where they were spread on shelves to dry. As soon as the cones opened the seeds were extracted and cleaned. Samples from this collection were placed in storage, various methods of storage being followed. A pint or more of the cleaned seeds were placed in a quart Mason jar in early November, the jar nearly filled with tap water, and the cover left loosely screwed in place. The jar was set to one side on the laboratory shelf until May of the following year, when I was surprised to find that the water covering the seeds, although discolored, appared fresh to the smell and taste. The seeds had been in this warm water (temperature of 70° to 76° F.)

for more than five months. The cutting test showed the seed apparently sound and viable. A sample of 200 seeds was taken from the jar on May 8 and sown in a germinating bed in the nursery at the botanical garden. The progress of germination was as follows:

10 days, 54 per cent
20 days, 59 per cent
30 days, 59 per cent
60 days, 59 per cent

The cutting test made at the end of 60 days showed no apparently sound seed remaining. Germination was complete at the end of 20 days, in this case, after the seeds were stored over winter in warm water.

In contrast to this rapid and complete germination are the germination tests on samples stored dry over the winter. During the past 28 years the writer has received a number of samples of the seeds of this species from dealers. These seeds arrived in air-dried condition in January or early February of nine different years, and were tested in February and March. In each case samples of 100 seeds were tested in soil in the greenhouse.

Of the nine samples collected in nine different years, which were stored dry until tested, not a single sample showed over 8 per cent germination in 60 days. One sample gave 8 per cent; others 6, 2, 2 and 1 per cent, and four none at all. Cutting tests on the ungerminated seeds in these samples gave in each case a relatively high per cent of apparently sound seed, in one case 82 per cent.

From this experience it appears that bald cypress seeds should not be stored dry over winter. Rapid and complete germination follows wet storage, the seeds apparently keeping as well in warm water as in cold. Seeds sown in the seedbed in the autumn, seeds stratified in moist sand over the winter, and seeds stored on the surface of the soil under a mulch of leaves, all germinated early completely the following spring.

J. W. Toumey.

Relation Between Age and Diameter in Trees of the Primeval Northern Hardwood Forest[1]

The beech-maple-hemlock climax of the so-called northern hardwoods region of the northeastern United States and adjacent Canada is commonly described, among other things, as being an all-aged forest, and this feature is emphasized as an all-important factor in the ability of this forest to perpetuate itself. Certain it is that, in a primeval forest of this type, trees of all sizes are well represented, from mature and overmature veterans down through progressively smaller sizes to specimens but a few inches tall, with the smaller trees as a rule far out-numbering the larger ones.

The natural inference drawn from this condition has usually been that the observed differences in tree size were correlated with corresponding differences in age. Published figures in support of this inference, however, would seem to be mostly lacking, and there are those who would urge that the observed facts

[1] Paper No. 301, Department of Botany, Kansas State Agricultural College, and a contribution from the Osborn Botanical Laboratory of Yale University and the Biological Station of the University of Michigan.

TABLE 1

DIAMETER-AGE FIGURES FOR HEMLOCK (*Tsuga canadensis*)

Diameter of stumps at cut surface [a]		No. of trees examined	Age class, years									
Inches	Centimeters		1-25	26-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400	400 +
			Percentage of trees by diameter and age classes									
0–4	(0–10)	53	11.3	34.0	43.4	9.4	1.9	....	....	....	....	....
4–8	(10–20)	32	....	....	34.4	43.7	18.8	3.1	....	....	....	....
8–12	(20–30)	10	....	....	20.0	40.0	10.0	20.0	....	....	....	....
12–16	(30–40)	13	....	....	....	23.1	30.8	46.1	....	....	10.0	....
16–20	(40–50)	23	....	....	....	13.1	21.7	47.8	8.7	....	....	....
20–24	(50–60)	19	....	....	....	5.3	5.3	52.6	26.3	10.5	4.3	4.3
24–28	(60–70)	11	....	....	....	....	9.1	36.4	36.4	9.1	....	....
28–32	(70–80)	6	....	....	....	....	....	16.7	50.0	33.3	9.1	....
32–36	(80–90)	10	....	....	....	....	....	10.0	20.0	30.0	....	....
36–40	(90–100)	1	....	....	....	....	....	....	....	100.0	40.0	....
											....	....

[a] In each case, diameter classes read *from* the first figure just through the second figure.

TABLE 2

DIAMETER-AGE FIGURES FOR SUGAR MAPLE (*Acer saccharum*)

Diameter of stumps at cut surface [a]		No. of trees examined	Age class, years							
Inches	Centimeters		1-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400
			Percentage of trees by diameter and age classes							
0–4	0–10	3	33.3	66.7	....	....	....	....	....	....
4–8	10–20	7	42.8	57.2	....	....	....	....	....	....
8–12	20–30	26	....	34.6	30.8	30.8	....	3.8	....	....
12–16	30–40	33	....	18.2	36.4	18.2	27.2	....	....	....
16–20	40–50	23	....	13.0	26.1	39.1	21.8	....	....	....
20–24	50–60	25	....	....	44.0	20.0	24.0	12.0	....	....
24–28	60–70	12	....	....	41.7	16.7	8.3	8.3	16.7	8.3
28–32	70–80	5	....	....	20.0	40.0	20.0	....	20.0	....
32–36	80–90	5	....	....	....	....	40.0	40.0	20.0	....
36–40	90–100	1	....	....	....	....	....	....	....	100

[a] In each case, diameter classes read *from* the first figure just through the second figure.

by no means warrant such a conclusion. In support of this latter contention may be pointed out such known facts as these: That trees of the same age may differ greatly in size, when grown under different conditions of moisture and light; that the appearance of youthfulness in trees growing suppressed under a forest canopy is commonly misleading; that in second-growth stands which exhibit a marked diversity of size classes all of the trees may be found, upon cutting, to belong to the same age class; that the second-growth forest which develops after a selective cutting of the original primeval forest may prove, upon cutting, to be made up very largely of trees which are approximately even-aged.

An opportunity to secure some age figures for the northern hardwoods forest has been presented during the past two summers in connection with the removal of a large stand of primeval beech-maple-hemlock forest situated west of Pellston, Michigan—one of the last few remnants of the climax forest which formerly covered a large portion of the northern half of the lower peninsula of Michigan. During the summer of 1928 the plant ecology class at the University of Michigan Biological Station made a thorough series of ring counts and diameter measurements on about 175 stumps, mostly sugar maple (*Acer saccharum*), distributed over an area of about 80 acres, near the center of this tract. The stumps examined were practically all more than 8 inches in diameter at the cut surface, since the cutting had been selective, most of the trees below this size being left for purposes of reproduction. In order to complete the study, permission was secured from Mr. W. K. Jackson, president of the Jackson & Tindle Lumber Company, to cut a representative series of the smaller-sized trees, and this work was carried out by the ecology class during the summer of 1929. At this time measurements and ring counts were made of about 185 trees of all sizes, mostly hemlock (*Tsuga canadensis*), distributed over an area of about 60 acres, adjoining the first area studied. The figures secured during both seasons, for sugar maple and hemlock, are presented in the accompanying tables. The height of the cut stumps above the ground ranged from 2 to 3 feet for the larger, "lumbered" specimens, and 6 to 12 inches for the smaller specimens cut by the class.

For the area studied, these facts seem self-evident: (1) That the forest comprises a goodly representation of trees of all ages; and (2) that, in general, there is an approximate correlation between diameter and age among the constituent trees. Without doubt, similar studies of the maple-beech-hemlock climax have been made elsewhere, and it is to be hoped that the results of some of these may find their way into print.

F. C. Gates,
G. E. Nichols.

Fundamental Training for Specialization

Two years ago The Pennsylvania State Forest School granted students the privilege of securing training in fundamental subjects necessary for future specialization in forestry.

Graduates of forest schools, after a year or two of practice or directly on graduation from the usual curriculum in

forestry, were seen undertaking graduate work to fit themselves in a single year for some special field in forestry, such as forest research, forest soils, forest entomology, and forest diseases. Without a knowledge of the subjects fundamental to these special lines, they were attempting to rear a super-structure overnight.

The time seemed ripe to start training for special fields in forestry. The forestry profession had become highly specialized. Graduates were wanted who would at once take their place in special fields. The old method of training seemed inadequate. Criticism of forestry education had come largely from men in specialized lines seeking a product and not finding it.

The plan adopted permits students of high standing who have shown a natural fitness for some special field, by electives and allowed substitutions, to secure in addition to the essential forestry subjects from six to eight subjects fundamental to a special field. Several junior students of high standing were selected for training, and curricula outlined with the help of the instructors in the special fields. A student in soils in addition to the subjects in the forestry curriculum was able to pursue the following fundamental subjects:

Classification and Mapping of Soils.
Principles of Animal Biology.
Theoretical Chemistry.
Elementary Quantitative Analysis.
Soil Investigations.
Advanced Soil Mapping.
Agricultural Bacteriology.
Biocolloids.
Plant Physiology.

A student combining forestry with pathology in the Botany Department secured the following fundamental subjects in addition to eleven credit hours of botany required of all forestry students:

Problems of Heredity.
Botanical Problems (full year course).
Mycology.
Botany Technique.

No attempt was made toward specializing in these various fields by combining forestry with them. Fundamental training only was desired. Several of these students are now in graduate forest schools for specialization.

Those interested in forestry education, realizing the difficulties of scheduling irregular subjects, will be interested to know how it was possible to schedule these subjects. The secret lies in the willingness of instructors, both in forestry and the chosen line, to devote time personally to students. Some subjects were recited directly to the instructor outside of the class room. If was found that these students not only carried the work as given to the regular class, but accomplished much more. Being high standing students their progress was rapid. Practicum work in many cases was done at times other than those scheduled for regular classes. A student was placed largely on his own initiative.

These extra courses were taken without curtailment of the regular forestry courses. Eighteen credit hours are required of all students in the forestry courses. During the junior and senior years, a three-hour elective is granted to each student each semester. In addition, with permission of the head of the department, a three-hour subject may be scheduled, making a total of 21 hours, which is not excessive for a high grade student. By faculty action a student

standing over 85 in all subjects may also elect three additional credit hours a semester.

By this plan a few students are prepared by fundamental training to advance rapidly in special lines in forestry through graduate study.

There are many possibilities of combinations of forestry with other lines. Students now in the forest school are pursuing courses in animal husbandry as a basis for range management; economics for forest economics; chemistry for chemist in forest products; entomology; business courses; and others. One student is taking courses along pre-legal lines planning to specialize in forest and timber law.

This plan has been found to be a great incentive to high standing during the freshman and sophomore years in order to be granted the privilege of securing special training. Instructors have found it an inspiration to deal with at least a few students with a real interest and a goal.

J. A. Ferguson.

Boy Scout Merit System Used in Training Foresters in the Woods

During the first year of the forestry course at The Pennsylvania State Forest School, the students are located at Mont Alto. Advantage is taken of the proximity of the Mont Alto state forest and the state forest nursery to train students in practical forestry work. The freshmen spend one day a week and the ranger students two days a week working as a crew under the direction of a state forest ranger, engaging in all the physical activities connected with the operation of the state forest and state forest nursery.

The work includes road and trail construction and maintenance, pruning of growing plantations, brush burning, preparation of sites for planting, fire protection, construction and maintenance of fire lines, nursery practice, planting operations, etc. The endeavor is to make the students woods-wise and woods-minded and to fill their minds with illustrations before they undertake the study of advanced courses in forestry. Much forestry material formerly taught to sophomore and junior students is now given to these first year students at Mont Alto.

There is much in addition to this practical training in the woods, however, that should be required of forestry students to make them woods-wise. They should know the birds of the region, the different kinds of fish, reptiles, and game animals, their propagation and protection. They should know the wild flowers and shrubs as well as the trees, be able to handle woods tools with skill and effect, to file saws and sharpen axes, to make collections of insects and tree diseases while in the woods for future study. They should know the principal constellations of stars, be proficient in the use of the compass, in the tying of knots in rope, in cooking for themselves in the woods, and a score of other practical things that all combined tend to make the able-bodied woodsman.

It was impossible within the limits of a college schedule to arrange for classes in all these subjects. The plan adopted to assure the students securing the required skill and information is similar to

the merit system of the Boy Scout organization. Each of these various lines has been made a merit. The members of the freshman faculty have been constituted a "Board of Examiners." As soon as a student considers himself proficient in one or more of these lines he is examined, and if so found he is awarded the merit; first, second, and third class merits being granted. A year and a half is given in which to secure all merits required. Unless a student averages at least equal to a second-class woodsman, he cannot continue as a student in forestry.

The merits required of forestry students to qualify for various degrees and for woodsman are as follows:

DEGREE, WOOD HICK

Ditch Digger	Pick
Clod Heaver	Shovel
Wood Chopper	Axe
Butcher	Hatchet
Trimmer	Pruning Saw
Sawyer	Cross Cut Saw
Road Monkey	Road Maintenance
Nursery Man	Nursery Work
Fire Fighter	Fighting Forest Fires
Brush Hooker	Cutting Brush with Hook
Mower	Use of Brush Scythe
Saw Fitter	Filing and Joining Crosscut Saws
Axe Grinder	Sharpening and Hanging Axe
Rigger	Tying 15 knots
Cooker	Camp Cooking

DEGREE, NATURE FAKER

Ornothite	Identify 50 birds
Botanite	Collect, Mount, and Classify 50 Wild Flowers
Entolite	Collect and Mount 100 Forest Insects
Fungite	Collect 20 Fungi of Forest Trees
Dendrolite	Collect, Mount, and Identify Leaves of 60 Trees
Shrubite	Collect, Mount, and Identify Leaves of 15 shrubs
Twigite	Collect, Mount, and Identify Twigs of 50 Trees and 15 Shrubs
Astromite	Identify 15 constellations
Fishite	Propagation, Protection, and Identification of Fish of Region
Gameite	Propagation, Protection, and Identification of Game of Region
Reptilite	Identify Snakes of Region

DEGREE, WOODSMAN

Compassman .....Use of Compass in Running Lines
Surveyor .....Compass Survey and Map of Ranger Station Area
Cruiser .....Ocular Estimate of Heights, Diameters, and Volumes of Trees and Stands
Estimator .....Individual Estimate of 20 Acre Plot
Carpenter .....Diagram for Cabin with Bill of Material
Bridge Builder.....Diagrams of Bridges, Culverts, and other Constructions to Scale

J. A. FERGUSON.

PHLOROGLUCIN AS A STAIN TO AID IN DETERMINING GROWTH RATE OF TREES

Foresters and ecologists whose work involves a study of the growth of trees are aware of the difficulty in counting the annual rings of some hardwood species. The age of the ring-porous hardwoods frequently is as readily determined as that of the conifers. With diffuse-porous woods, however, the annual rings are not sufficiently distinct from one another, which leads to errors in the age counts of trees and in turn introduces marked inaccuracies in arriving at the growth rate. For a number of years the writer has been engaged at the task of assembling data evaluating the growth rate of trees. In the main, hardwood species predominate in the field under consideration. Often stumps on cut-over tracts are used instead of standing trees.

In order to intensify the contrast between the annual rings, several stains were tried without any marked degree of success. The writer then consulted Dr. F. H. Steinmetz, of the University of Maine, who suggested the use of a lignin stain, such as phloroglucin. Experiments with this reagent resulted in successfully staining increment cores so that the annual rings were readily distinguishable. Phloroglucin will stain the lignified portion of either a core or the freshly cut surface of a stump, but the addition of hydrochloric acid intensifies the stain. The cellulose of the wood is left unstained. Lignin, of course, is disseminated throughout the wood, but it is of the greatest density in the late summer wood, which, therefore, takes a more intense stain. The annual rings are thus brought into contrast by the intensity of the lignin stain.

The writer has improvised a field kit and has developed a technique which is rapid and accurate. The kit consists of a flat canvas case which contains pockets for the following articles:

½ dozen camel's hair brushes.

1 six-inch test tube filled with phloroglucin.

1 six-inch test tube filled with hydrochloric acid.

1 twelve-inch stem analysis rule.

1 twelve-inch increment borer.

1 carpenter's gouge—¾ inch (outside ground).

1 reading glass, 4 to 10X.

1 hand lens, 12 to 20X.

1 small flat box for preserving increment cores.

This kit has two compartments, the flap containing one large pocket for a note book and recesses for pencils.

Growth studies may be conducted on logged-off lands where the stumps are still sound. The average radius is determined and marked in pencil. A smooth groove is then cut with the gouge along this line and brushed thoroughly with the phloroglucin solution and then with dilute hydrochloric acid. The next stump may be prepared while the reagent is reacting. Five minutes is usually sufficient to complete the staining process.

Increment cores from standing trees are best carried in some sort of convenient container, and the ring counts made in the laboratory. The cores are best stained by dipping them into test tubes or by immersing them in shallow dishes containing the stain and the acid respectively. Drying does not interfere with the work except that dry cores absorb more of the reagent than fresh ones. In the field the test tubes may be carried in a pine block containing cavities into which they fit. The tubes may be stoppered with perforated, rubber stoppers into which small camel's hair brushes have been inserted.

The phloroglucin is used in approximately five per cent aqueous solution. The hydrochloric acid is prepared by adding two parts of water to one part of concentrated hydrochloric acid. These two fluids may be mixed and used together, but in field work this is not the most economical method.

The annual rings of maple, beech, and cherry are readily determined by this method. Annual rings of birch are less successfully counted, but without the stain it is next to impossible to make age counts. The stain is not always necessary with ring-porous woods, although the counting of the annual rings of slowly grown specimens is facilitated by its use. Even the annual rings of slow-growing coniferous woods are rendered more conspicuous by the use of phloroglucin. The number of counts which may be made in a day by one man is approximately doubled by the procedure outlined.

The work involved in counting the rings of the increment cores brought into the laboratory may be facilitated by the procedure given below. A pine board 6 by 12 inches is prepared by cutting a straight, shallow groove in it. Along one side of the groove a scale is marked off in tenths of inches or an increment rule may be fastened in like position. The core is placed in the groove and the rings checked off directly against the units of the scale. The magnifying glass found best adapted to this work is a banker's rectangular check lens. The legs of the lens are placed astride of the core so that both hands of the worker are left free to handle cores and to record data.

GILBERT STEWART.

DOUGLAS C. INGRAM

When on August 13, 1929, the Camas Creek fire on the Chelan National Forest in Washington caused the death of Douglas C. Ingram, assistant chief of the office of range management in Portland, Oregon, the Forest Service lost one of its most progressive and enthusiastic foresters. No one will ever know just what happened. The fire was exceptional. The weather was extremely dry, the forest was unusually inflammable because of the high percentage of insect-killed lodgepole pine, and high winds

caused a terrific "blow-up." A day or two before, Ingram, as camp superintendent, had shown exceptional courage, coolness, and leadership in leading a crew out of a trap to safety. Likewise on August 13 he had called the men off a part of the fire line which later "blew up," as he felt the danger was too great for them to remain where they were. He and Ernani St. Luise of Chelan, Washington, then walked on down the ridge to obtain a better idea of what the fire was doing. The fire made a quicker jump than even an experienced woodsman like Ingram could have anticipated and all evidence indicates that the two men were cut off by fire, both above and below, trapped, and suffocated before the flames reached them.

Ingram is survived by his wife and daughter, living in Maplewood, Oregon, his mother, two sisters, and two brothers.

"Doug," as he was affectionately called by all who knew him, was born in Elgin, Scotland, November 26, 1882. He was educated in Bedford, England, where he completed the equivalent of high school and one year of collegiate work, and then came to the United States. In 1909 he finished five months of the University of Washington short course in forestry.

Entering the U. S. Forest Service as a forest guard on April 1, 1909, on the Ochoco National Forest, Ingram became an assistant ranger on July 1, 1909, and, on July 1, 1911, forest ranger in charge of the Mill Creek Ranger District. He was promoted to the position of grazing assistant July 1, 1917, and to grazing examiner in the office of grazing in Portland, August 9, 1918. In 1921 he was given charge of grazing studies for the Pacific Northwest District, and on January 1, 1929, was transferred to the administrative position of assistant chief of range management in the district. Although not a member of the Society of American Foresters at the time of his death, he had been a member previously for several years and showed a keen interest in the affairs of the Society.

Ingram felt keenly the need for better range management and threw his untiring energy and great enthusiasm into an honest and sincere effort to solve some of the more important problems. He had in marked degree the true research spirit. Studious by nature, and an industrious and conscientious worker, he was always seeking new knowledge and interesting those with whom he came in contact in a similar purpose.

While a ranger on the Ochoco Forest he put into practice on his district the most up-to-date range management principles then available. It was Ingram who, from his studies, first brought out the fact that excessive early utilization results, through loss of vigor, in a considerable delay in the date at which range forage becomes ready for grazing. Taking on a double load in range appraisal, when illness required one of his coworkers to withdraw from it, Ingram carried this double assignment to a successful conclusion.

For years he has been appalled by the great loss of feed on cut-over lands west of the Cascades and the extreme fire menace which lack of use of this vegetation meant to the new timber crop. In recent years his efforts have largely been concentrated on this problem. Several valuable contributions concerning it have been published or are in course of publication.

His intimate knowledge of what the ranger has to contend with, his sympathetic understanding of administrative problems, his clear insight into ways and means of applying better management, his dynamic personality, and his fine sense of humor made his investigative contacts and his administrative inspections of unusual value. In the Pacific Northwest practically every national forest and every botanical and other worker interested in range management felt and appreciated his influence. Although his work was mainly of regional interest it was of sufficient general value so that it is now being well recognized in other parts of the country.

Ingram put into his photographs the same painstaking conscientious effort that characterized his other work. He proved to be one of the best photographers in the Forest Service and his pictures of plants in their native habitat and of important range management practices are unequaled.

He was intensely interested in plants and was a keen observer of their growth characteristics and grazing value. He had not only collected the greatest number of plants of any forest officer but his ecological and economic notes on them are unsurpassed. His collections added several species new to science, extensions of range for numerous others, and valuable notes on many rare and little-known species, as well as essential basic information on the more important range plants. As Tidestrom and Dayton so aptly said in their paper on *Silene ingrami,* one of the new species of plants brought to light by him and named in his honor, " Douglas C. Ingram not only is a highly efficient forest officer and an authority on range management, but is also recognized as one of the best field naturalists of the Northwest." He transplanted into his own garden many of the beautiful native flowers which he collected on the range, and was able to propagate plants that others with less insight and perseverance gave up as a hopeless task. No one ever spent some time in that garden with Doug without gaining a better appreciation of God's great handiwork.

Ingram's published articles include:

Our Native Plants. Hood River Glacier, Apr. 19, 1928, p. 4.

Historical Backgrounds of Some of Our Northwestern Plants. Mazama, Dec., 1928, Vol. 10, No. 12, p. 57.

Grazing as a Fire Prevention Measure for Douglas Fir Cut-over Land. Journal of Forestry, Dec., 1928, Vol. 26, No. 8, pp. 998-1005.

The Work of Flowers. Better Flowers, May, 1929, p. 13.

Oregon's Own Primula. Better Flowers, Aug., 1929, p. 7.

Douglas Fir Cut-over Lands' Fire Hazard is Minimized by Grazing. U. S. Dept. of Agr. Yearbook, 1929, pp. 260-3.

Water by Motor for Stock-watering and Fire Protection. The Forest Worker, Sept., 1929.

W. R. CHAPLINE.

SOCIETY AFFAIRS

Kelley Reviews Fire Situation in District 1 for Washington Section

At the December meeting of the Washington Section Major E. W. Kelley, District Forester from Missoula, Montana, with charts and figures reviewed in an interesting manner the 1929 forest fire season in the Northern Rocky Mountain District.

According to Major Kelley's figures there was a 56 per cent deficiency in moisture content in the Spokane and northern Idaho country during the summer and fall of 1929. This condition along with accompanying high winds throughout a great part of the season resulted in one of the worst forest fire seasons in history.

Major Kelley stressed very strongly the need of additional roadways and trails into the now inaccessible forest areas in order that fire fighting crews may reach fires promptly. Figures and charts were exhibited to show that as additional roadways and trails had been extended into the national forests, the area of burned-over forest land had been correspondingly reduced. With the present rate of appropriations for improvements it will require fourteen years longer to construct a sufficient mileage of roads and trails to protect the national forests adequately.

To show the urgent need of roadways and trails, an example was cited where a crew of men and a number of pack and riding animals were transported eighty miles within three hours by automobile truck from Spokane to one of the northern Idaho forest districts. At the end of the truck road the men unloaded the horses and pack outfits and started across the mountains to the fire some twenty miles away. Owing to the very rough country and lack of roadways and trails it required nearly two days for the crew to reach the fire, and the men were tired and pactically unable to perform work before obtaining rest, meanwhile the fire naturally had spread over a very large area.

The permissible acreage which could be burned over without endangering the nation's required production of timber is one acre in five hundred per year. During the 1929 season one acre in ninety-one was burned. In District 1, the area of land which is not restocking after fires has increased from 200,000 acres to 1,200,000 acres in the past twenty years. It is the plan now to bring about safe-hour control of all areas, which means a net work of roadways and trails to every portion of the forests to enable a fire fighting crew to reach any area on short notice. Approximately 43,000,000 acres of the western national forests lack adequate hour control. In the northern Rocky Mountain district 16 per cent of the total national forest area lies eight to forty-eight hours travel time away from the nearest road. One does not need to draw upon his imagination to

realize what an uncontrolled fire can do in that length of time.

Major Kelley also spoke of the serious insect epidemic raging throughout the Rocky Mountains and Pacific Coast, and of the white pine blister rust. Additional money is needed now to combat these destructive pests. Money should also be available to attack new outbreaks promptly.

In commenting upon the lack of money for protecting forests in the northern Rocky Mountain region Major Kelley called attention to the inadequacy of funds provided each year for forestry work on Indian Reservations. He cited the Flathead Reservation in particular, where insufficient funds are available to pay the salaries of the regular forest employees for this year.

Representative Scott Leavitt of Montana, Representative Smith of Idaho, Representative Colton of Utah, and Representative Englebright of California were present and took an active part in the discussion. These congressmen know forest fire conditions and are endeavoring to remedy the situation in the way of securing larger appropriations for roads, trails, telephone lines, and lookouts.

About sixty members and friends of the Section were present at the meeting.

E. Morgan Pryse,
Secretary-Treasurer.

Washington Section Debates Forest Policy

The meeting of the Washington Section on January 23 was devoted to a consideration of the program presented by the Forest Policy Committee at the annual meeting of the Society in December. F. W. Reed arose as the first speaker with the remark that "Since a great deal of knocking will probably be done at this meeting, the National Lumber Manufacturers Association has sent a weapon for the chairman's defense." This turned out to be a gavel made from a longleaf pine timber taken from the White House in 1927 which had been used in repairing the roof of that mansion following its destruction by the British in the war of 1812. The wood was found to be perfectly sound after 115 years' use in the White House.

Ward Shepard opened the discussion by reviewing his proposed substitutes for the first four paragraphs of the forest policy program as submitted at the Des Moines meeting. He feels that the present deplorable forest condition is due to (1) insufficient federal and state activity in the direct attack on forest destruction, especially in fire protection and public acquisition, as well as in such indirect aids to forestry as tax reforms, and research; (2) the failure of the government, the lumber and other forest industries, and other principal forest owners to come consciously and directly to grips with the specific practices that cause forest destruction and to go as far as possible in rapidly and progressively remedying them.

Mr. Shepard's plan to end forest devastation would be achieved through (1) the extension and intensification of cooperative methods to include all phases of forest practices, especially destructive logging methods; (2) the creation of adequate coöperative machinery, including a Federal Forestry Board, Regional Forestry Boards, and systematic, periodic conferences of organized timberland owners, comparable in definiteness of

purpose and persistence of effort with the American Lumber Standards Committee; (3) adoption of minimum regulatory measures comparable to those already worked out by the Forest Service in its "Timber Growing and Logging Practice" report; (4) assistance to the lumber industry in stablizing it, controlling overproduction, and obtaining cheaper capital.

Mr. Shepard next explained his proposed substitute for Section II, "Study of Public Regulation," in the forest policy program by saying that the forests of America are far too important from the public and national standpoint to permit their continued existence or their annihilation to hinge upon the absolutely voluntary choice of their transient owners. Therefore to bring about desired conditions he would develop nation-wide regulation under federal leadership but localized and democratized by a system of regional and local coöperative forestry boards, on which the forest owners would be represented.

A general and somewhat random discussion of the forest policy program followed Mr. Shepard's explanation of his substitutes. Taking up the recommendations beginning on page 2 of the program, section by section, the following comments were made:

1. W. N. Sparhawk and E. N. Munns do not feel it necessary or desirable for the government to acquire forest land with the idea of timber production which might be in competition with private industry. Mr. Munns holds that the government should confine its land acquisition to areas on important watersheds mainly for watershed protection purposes, for in so doing the timber production problem would take care of itself. E. E. Carter seems to be in favor of this. On the other hand H. H. Chapman believes it is wise for the federal and state governments to purchase land primarily for timber production which might not necessarily be in competition with private industry. H. N. Wheeler presented a strong argument to buy forest land, of which there are millions of acres suited for nothing better than timber production. Chairman Moore pointed out that Congress had apparently never taken that view very strongly if appropriations for land acquisition were any criterion. Major Stuart referred to the large areas of sub-marginal land, pointing out that an inventory and classification is desirable from an economic land-use viewpoint. F. W. Reed and others, apparently a majority, favored continued federal ownership and reasonable acquisition of forest land. O. M. Butler believes the acquisition of forest lands by the states should be encouraged and their forest policy strengthened.

2. Regarding the stablization of lumber industry, Mr. Sparhawk pointed out that the West Coast production is not the principal factor, as indicated in the forest policy program, but that the cutting of small, immature material in the South and East has a very large influence on the overproduction problem. R. C. Staebner does not favor amending the Sherman Anti-Trust Law as a means of bringing about stabilization in the lumber industry. Gov. Pinchot does not think it possible to amend this law. Major Ahern discussed the effect of imported lumber and pulp on stabilizing the lumber industry in the United States, special reference being made to Russia and other countries he had visited. He

concluded that foreign supplies would never have any effect on this country, that Europe would use all it produced. Prof. Chapman disagreed with this view.

3. Mr. Sparhawk believes that we should not insist on contributions in cooperative forest work from states and private interests until they are better organized and able to render the required coöperation. Mr. Staebner and Mr. Munns also believe the federal government should assume the full burden of fire protection on all forest land. Messrs. Wheeler and Hastings spoke vigorously for continued coöperative work.

4. All agreed that the national forests should be strengthened in administration, fire protection, and improvements.

5. Chairman Moore explained the status of Indian forest lands comprising approximately 6,000,000 acres. Mr. Kinney stated that the Society as a body has never taken an interest in forestry work on Indian reservations, and that such interest might help a great deal.

6. Retention of the Forest Service in the Department of Agriculture invoked a very spirited discussion. Mr. Munns objects to its transfer to the Department of the Interior not on the grounds that it is so closely related to research and agriculture, but because of the past record of the Interior Department in handling natural resources. Major Ahern also spoke of the Interior Department as unfit to handle the Forest Service. He stated that the question of transfer had come up in the Harding administration and had been pidgeonholed; that President Coolidge had considered the matter and left it *status quo;* and that now the question is up to Hoover, who will likewise let it rest. Gov. Pinchot also stated that it would be a great blunder to transfer the Forest Service to the Interior Department in view of its past record. Mr. Kinney with a great deal of emphasis stated that he had never advocated the transfer of the Forest Service one way or the other; that it was questionable for one government department or its representative to criticise another. He strongly defended the present Secretary and Assistant Secretaries of the Interior. He took issue with the remarks by Gov. Pinchot and others as to the inference that the Forest Service is the only service practicing forestry or able to handle forest land.

7. Mr. Wheeler spoke on "cellulose forestry," land classification, and various uses to which forest land can be put such as fur farming and recreation. He advocates growing timber and letting the farmer turn cornstalks and other farm by-products under the soil for fertilization. A land classification, he says, will reveal that there is an abundance of land suitable only for forest production without using by-products of the farm for paper, wall boards, etc. Major Ahern spoke of the downward trend of production of lumber and other forest products in nearly all the states. The exhaustion of forest products is in sight if remedial steps are not taken at once.

8. Messrs. Sparhawk, Pinchot, and Kinney spoke against a central forestry board. Gov. Pinchot thinks the majority report goes further than he advocates with respect to government regulations. He is not in favor of a forest commission to be appointed by the president, which he believes would be dangerous.

At this point H. A. Smith proceeded to take the forest policy program apart, piece by piece, and wreck it. The same

may be said of Mr. Sparhawk and Mr. Munns who criticised the report severely. Mr. Sparhawk moved that the entire report be rejected, the committee of 28 discharged, and a new committee of 5 or 6 appointed to write a policy program. After a great deal of discussion the motion was tabled. The chairman, however, used his prerogative by appointing Messrs. Smith, Sparhawk, and Munns as a committee from the Washington Section to prepare a substitute policy program for consideration at the next meeting. Mr. Smith thinks that insufficient time is being given to the study and preparation of a policy program and that several meetings should be devoted to the matter.

About 75 members were present at this interesting meeting.

E. Morgan Pryse,
Secretary-Treasurer.

The main subject for discussion at the meeting on February 13 was the substitute forest policy program prepared by a committee from this Section composed of W. N. Sparhawk, Chairman, E. N. Munns, and H. A. Smith. Mr. Smith made such reservations and comments as to leave the impression that he did not agree with Messrs. Sparhawk and Munns as to the plan submitted.

Taking up the substitute forest policy program, Mr. Moore pointed out that it recommends that public agencies should protect all forest land regardless of ownership. This recommendation was discussed at some length but never came up for a vote.

The section regarding public regulations came in for extended discussion. F. W. Reed stated that public regulation should not be put into effect until all chances of coöperative effort with private interests were exhausted. Then, and then only, should government regulation be resorted to. Robert Marshall in reply to Mr. Reed's comment suggested that public regulation would not need to be applied to those who coöperated but only to those who continued to devastate their forest land. E. E. Carter advocated early action to stop forest devastation. Awaiting coöperation is just delaying a matter that is becoming more serious to the nation's welfare all the time. Public interests are paramount to private individual interests.

Major Ahern expressed the same view. Mr. Munns cited Arkansas where it is very difficult to obtain coöperation in fire control or any other forest work. On the other hand H. A. Smith, while admitting the right of the federal government to control, pointed to the deep-seated Anglo-Saxon belief in private property rights. No successful and permanent results can be attained until the people see the need of forestry and its practice can be brought about by education and coöperation. Once these results are attained, the problem is solved for all time and there will be no feeling of resentment toward the government. B. A. Chandler feels the same way about public control. Mr. Sparhawk stated that public regulation has been in effect in Switzerland for generations. To this Mr. Oxholm replied that the Swiss system is based upon coöperative effort; that in fact coöperation with the forest owners is the basis of all public regulation in Europe. Also it is impossible to compare Switzerland with the United States. In that very steep mountainous country, practically all forested, the prac-

tice of forestry is closer and more vital to all its citizens than it is in the United States.

Mr. Kneipp at this point suggested that the section was spending a lot of time debating detailed ways and means as to the cause and effect of public regulation, questions that could only be worked out satisfactorily for each forest region over a long period of years. The main thing for consideration now is the principles, whether private or public control is for the best interest of forestry.

It was finally voted that, " The public should exercise such control of operations on private forests as will prevent forest destruction."

Arthur Ringland moved the adoption of sections 4 and 5, page 7, of the Sparhawk-Munns-Smith plan, which recommend a land use survey and plan, and acquisition of forest land by the public. There was no dissent to this.

The general feeling of the section seems to be that considerable time and study should be devoted to formulating a forest policy program for the United States in order to obviate all possible mistakes.

About 50 members were present.

E. Morgan Pryse,
Secretary-Treasurer.

At the meeting on February 27, Barrington Moore, Chairman, announced that E. Morgan Pryse, due to his appointment as Secretary-Treasurer of the whole Society, had resigned the secretary-treasurership of the Washington Section. On motion by A. C. Ringland, the Section thanked Mr. Pryse for his able services in this office. Chairman Moore appointed A. E. Fivaz to fill the vacancy.

J. P. Kinney informed the Section as to the Indian lands legislation now before Congress. There are four bills, applying respectively to the Colville, the Yakima, the Warm Spring, and the Klamath Indian Reservations. Each bill provides for the classification of Indian lands according to their suitability for agriculture or for forestry, and for the setting aside and management of forest lands as Indian Forests; the proceeds from such management to be deposited at 4 per cent interest in the United States Treasury to the credit of the Indians. He stated that the Colville and Yakima bills have been approved by the Indians on these reservations, that the Warm Spring Indians have not yet taken definite action but are favorably inclined, and that the Klamath Indians oppose the bill pertaining to their reservation. He submitted the following resolution:

Whereas, Various Indian reservations within the United States have very large areas of land primarily adapted for the production of forest crops or urgently needed for the purposes of water conservation, approximately 6,000,000 acres, and

Whereas, The maintenance of such lands in large units of consolidated ownership and the permanent retention of a forest cover upon the said lands will not only insure a sustained income for the Indian owners but will also be highly beneficial to the people of the state in which the forest land is situated and to the people of the nation at large; therefore, be it

Resolved, That the Society of American Foresters urges the enactment of federal legislation that will afford a definite legal status as " Indian Forests " for all unallotted lands within Indian

reservations that may be found to be primarily adapted to the production of forest crops, needed for the purposes of water conservation, or contributory to the prevention of soil erosion.

The Section decided unanimously to recommend to the Council of the Society the adoption of this resolution and the taking of suitable action to bring the support of these bills by the Society to the attention of Congress.

After considerable discussion on the substitute forest policy submitted by a committee of the Section on February 13 the Section voted affirmatively by a considerable majority on the question: "Is some kind of public regulation of private forest land now necessary?"

Following a discussion of the clause in the substitute policy which urged that the federal government undertake the fire protection of forests on the watersheds of navigable streams, motion was made by B. A. Chandler and seconded by J. P. Kinney that the Section favor the fire protection clause in the majority report of the national policy committee. The motion was adopted by a considerable majority.

H. A. Smith, after considerable discussion of the 25-25-50 ratio for funds for forest protection, moved that, "Direct contributions from private owners towards forest protection is a sound forest policy." The motion was defeated.

About 50 were in attendance.

A. E. Fivaz,
Secretary.

Flory and Tinker Address Washington Section

At a meeting of the Washington Section on March 18, District Forester C. H. Flory spoke on the part of forestry in the economic development of Alaska, which, he said, is America's last frontier, a land full of mysteries and surprises. No other territory under the American flag is as little known or understood.

Alaska is continental in extent, and has four main physiographic provinces:

1. The coastal crescent, a more or less broken mountain range.
2. The great valley of the Yukon.
3. The Brooks Range, a continuation of the Rocky Mountain system.
4. The great tundra region.

Each of these sections has its own climate. The coastal region has cool summers and mild winters. Rainfall is heavier than in any part of the continental United States, averaging as much as 157 inches a year in one place. The Yukon Valley experiences hot summers and cold winters, the climate in the interior being much like North Dakota and Montana. The Brooks Range is much like the coast range, but has fewer glaciers and less snowfall. The arctic slope or tundra region has probably less snowfall than the rest of the territory.

Alaska has a great variety of forest growth as a result of this variety of climate. The coastal section has rain forests of tropical density. This density, together with the slow decay of down material, renders these forests almost inaccessible for travel on foot. The region is very heavily timbered with spruce, cedar, hemlock and a few true firs. Douglas fir reaches its northern limit on the coastal islands, at the northern end of Vancouver Island in British Columbia, but extends farther north on the mainland coast. Western red cedar stops suddenly at Frederick Sound in south-

eastern Alaska. True firs reach the southeastern portion of Alaska.

The Yukon Valley has forests of white spruce, white birch, and black spruce. The latter does not amount to much, growing chiefly in the swamps. The white spruce and white birch are found on the hillsides and the better drained lands.

The Brooks Range itself has comparatively little timber, but dense stands of spruce and several sawmills are situated on the Kobuk River in the northern part of this region above the arctic circle.

The tundra region is absolutely treeless, but it has a part in the economic welfare of the Territory.

In the interior, the valleys of the Yukon, Kuskokwim, and Tanana Rivers comprise probably 100,000 square miles of potential agricultural land capable in time of sustaining several million people. This is also a caribou and fur-bearer region. There is probably twice as much timber in the interior of Alaska as in the rain belt on the coast. The latest Forest Service figures estimate the amount of timber on the Tongass National Forest as 75 billion board feet and on the Chugach as 5 billion. There is probably 160 billion feet in the interior. This timber is smaller than that on the coast, averaging 12 to 14 inches in diameter, and is also slow growing. Forest fires run rampant through this region, because it is so hot and dry in summer. No attempt is made at control.

Mining is playing an important part in the economic development of Alaska, and the fisheries in Alaska yield an annual return of 50 million dollars.

The tundra region is important to the reindeer industry. About 1200 head which were imported 30 years ago from Siberia have now increased to approximately 800,000 head. There is sufficient tundra to support 5 million head. Alaska can produce probably a million head a year. It is now shipping 25,000 to 30,000 head a year. This industry is not competing with the cattle industry, as the product is a distinct specialty. Even if one million head were shipped a year, this would represent but a pound and a half per capita for the people of the United States.

The economic development of Alaska must take a different course from that of the United States. Other industries must be developed first, then agriculture will necessarily follow. Fisheries have reached their full development, being regulated by the Bureau of Fisheries as to their maximum annual catch. Mining is uncertain—no commonwealth can build on that industry alone. The raising of fur-bearers is an industry distinct from agriculture. It offers a great opportunity for development. Already 5 to 6 million dollars worth of fur is shipped annually from Alaska, including both wild and farmed fur.

The forests, however, provide a basic industry. There is probably sufficient timber in the national forests alone in Alaska to produce a quarter of the newsprint requirements of the United States in perpetuity. Conservatively estimated, one million tons of newsprint can be produced annually. Most of the forests are overmature and should be removed. The length of the rotation is estimated at between 80 and 90 years. More spruce is expected from the second crop. Now, spruce makes up between 20 and 25 per cent of the stand, the balance being hemlock and other species.

Practically all of the land outside of incorporated towns is owned by the government. The Tongass National Forest has the distinction of being the only forest including a state or territorial capital. Unique also is the fact that most of the population along the coast is found in towns which are inside the exterior boundaries of the national forests. This part of Alaska is destined to remain the most populated region of the territory. As fast as possible the agricultural land on this forest is being turned into private ownership.

Fires occur rarely and do not amount to much in the coastal forests, but in the interior of Alaska the number of fires and damage caused constitute a very serious problem. Not only is the timber damaged, but the reindeer industry suffers through injury to the reindeer moss. This plant, the mainstay of the reindeer, grows but 1/16 to ¼ inch a year, and it takes many years to replace it following a fire. The coyote has invaded the Territory in the last dozen years and is playing havoc with the caribou, mountain sheep, and even the reindeer herds. Coyotes frequent the burns. Unless the federal government gives fire protection to the interior of Alaska, it is only a question of time until it will be as bad off as the Lake States.

In answer to questions, Mr. Flory said that the types of farming that will be practiced in Alaska are dairying, the raising of poultry, pork, and other livestock in the Matanuska Valley, and grains and potatoes primarily but also livestock in the Tanana Valley. The grains used are not of the same strains as those of Canada, but were specially developed in the Territory. The forage crops are also of locally developed strains. Only ¼ of Alaska is inside the Arctic Circle, and practically all vegetables of the temperature zone can be grown in other parts of Alaska.

The availability of water power is the limiting factor at present in the utilization of the timber. About 500,000 or 600,000 horsepower are available in Southeastern Alaska which will play an important part in the development of the pulp and paper industry. The forests of interior Alaska have a conceivable but not predictable economic importance outside the pulp and paper field. There is, however, a real possibility right now of developing the farming population of the interior.

Outside of the two national forests, practically the entire Territory is national domain. There are 16 million acres in the Tongass National Forest and 5 million in the Chugach. Only a relatively small part of this area is covered with commercial timber, but the amount of timber in the aggregate is great. In the Tongass National Forest, 75 per cent of the timber is within 2½ miles of tidewater. The interior is high, barren, and snowbound. The Forest Service has secured the coöperation of the Navy in making aerial surveys of this region. These have resulted in discoveries of valuable water powers hitherto unknown.

The value of Alaska forests in regulating streamflow is very important. A considerable portion of Alaska is in the last stages of the glacial epoch. In all the interior country north of the coast range, the subsoil is perpetually frozen down to the bedrock. Once this is thawed out it never again reaches that state. The rainfall in the interior valleys is only 12 to 15 inches a year but the frozen condition of the subsoil make most of this

rain available for crops. As the frost line goes down, however, arid conditions may in time result.

District Forester E. W. Tinker next spoke on the work of land acquisition by the Forest Service in the Lake States, and its relation to the forest situation in the north central region. He brought out the fact that the lack of an available supply of timber in the northern Lake States was of importance not only to the Lake States themselves, but also to the states to the south where there exists an enormous industrial development based upon available and accessible supplies of coal, steel, and gas. The only major element lacking to these industries is an available wood supply. The fact that in 1919 the price of lumber in southern Minnesota included an increased cost of importation of about $9.00 per thousand board feet over the cost when an available supply existed in the northern Lake States, and that this figure is now probably at least $12.00, clearly illustrates the point.

A more recent factor that has come to an increasing extent into the picture, is the need for public recreation grounds. The rapid closure of private lands to public use for this purpose is already curtailing public recreation to some extent. If the lands acquired by the United States can be developed for this use, Mr. Tinker stated that the interstate importance of these lands would be vastly increased.

The present plan is to develop the national forest areas in the Lake States as demonstrations of forest management, silviculture, and the coördinated use of forests on a large scale. The demonstration that is already available in existing national forests has proved of value in awakening local companies to the possibilities of forest protection on their holdings and has resulted in some specific action. Areas acquired by the government for demonstration purposes must be conveniently located and must be outstanding if they are to serve the purposes set forth by the National Forest Reservation Commission.

The areas now being acquired include those within national forests already established as well as five new units which will be purchased in their entirety. Care is taken to get areas which have soil and forest conditions representative of the major types of the region, and which will be accessible to large numbers of people.

There has been much misunderstanding relative to the methods of selecting purchase areas. One accusation is that the worst areas are being bought first. This is not the case. One national forest area was enlarged by purchases which contained some very light stands in the original forest unit. However, a balance of soil types is being acquired by the enlargement of the unit. In making purchases the forest cover has received a minimum of consideration. Nevertheless, even the poorest soils have some growth on them that will develop marketable values, and even though no further action is taken it is regarded as certain that the government would receive a reasonable return on its investment.

The greater part of the lands within the purchase units, amounting in all to about 1,200,000 acres, should be planted. This also should be a paying investment and will be vital to the development of demonstrational values. By and large, private owners will also have to plant if they desire to obtain within a reasonable

period anything like maximum production of values from the land.

Whether or not virgin timber should be purchased was a problem easy of solution. With virgin timber having an average value of around $7.00 per thousand in hardwood stands averaging close to 10,000 feet per acre, it was obvious that until the fiscal situation was better the cheap land should be bought first.

With respect to the attitude of the states toward the federal purchase program, Mr. Tinker stated that by and large they accepted the federal projects as state aid and welcomed federal activities. There is general recognition that private initiative will not even approach a solution of the situation.

In response to a question if a policy of waiting until the land reverted to the state for taxes would not be better for the federal government, Mr. Tinker stated that it is preferable to deal with the private owners, as generally part of the purchase price then goes to the needy county.

Mr. Tinker's talk led naturally to a discussion of the acquisition part of the substitute national forest policy drafted by a committee of the Washington Section. This policy suggests the acquisition of approximately 37,600,000 acres of land chiefly for the protection of navigable streams and to block out existing national forest areas; suggests the advisability of acquiring additional acreage of marginal land to withdraw it from cultivation and erosion and incidentally aid the agricultural problem; and suggests that no land be acquired for the primary purpose of commercial timber production, in competition with private initiative.

L. F. Kneipp stated that the last part of this suggested policy conflicts with the Clarke-McNary Act, which extended purchase by the federal government to lands not essential for watershed protection where forestry will pay a timber dividend. The Society, he urged, should make sure that existing conditions warrant declaring this part of the Act to be wrong before such action is taken. Existing conditions, he said, do not warrant such a decision. East of the Great Plains only the states of Pennsylvania and New York, aside from the federal government, have definite policies insuring forest management. The most ambitious federal program provides for only 4.3 per cent of the forest land east of the Great Plains, or about 16,000,000 acres.

R. Y. Stuart brought up again Ward Shepard's proposal to let the tax delinquency situation continue until federal aid becomes imperative, when the government can get the land for nothing. He believes that the government has a positive duty and that the federal program of 1924 and of today is moderate. Public control, he said, is to curb acts of commission. But in the Lake States, as in much of the East, the act of commission has taken place, there is nothing left to regulate, and the question is will anything be done to curb the act of omission. Acquisition is meant for this purpose. Although expansion of the purchase program is advisable, Major Stuart said that unfortunately there is little promise of immediate expansion.

W. N. Sparhawk, in explaining the stand taken by the Section policy committee, said that the federal government should concentrate on the land the government will have to acquire eventually,—poor land and land on watersheds. Productive lands should be under regulation, in private ownership.

H. N. Wheeler suggested that instead of buying a few million acres the federal government should acquire a hundred million, that at least a third of the 350 million acres of forest land should be in national forests. He suggested that half of the forest land east of the Great Plains be acquired by the federal government.

E. N. Munns said that lands which are owned or which may be acquired by states, counties, and local governments should be taken into account. If the country is divided systematically into states, watersheds, and smaller divisions, the amount which should be in public ownership can be determined closely on the basis of soil, climate, and other local conditions. This study can be accomplished by a small group of men but it is impossible by discussion to arrive at a sound figure at this meeting.

Ward Shepard brought out the inadvisability of paying the people who devastated the land by purchasing it before it reverts to the state or county as tax delinquent. Mr. Kneipp answered that the "lumber barons" actually received very little for the land, probably 50 cents an acre. They must pay all taxes levied before the purchase is made. A refusal to buy this land penalizes the nation as well as the owners who spoiled the land. The purchases are made at the moving value of the land, Mr. Kneipp stated; the government is not interested in land until its asking price is dropped to an absolute minimum. After the land in the Lake States is purchased, it becomes subject to small operators who improve the stand. In the southern Appalachians, economic conditions do not now permit this.

On motion of J. P. Kinney the Washington Section voted to affirm the essential agreement relative to land acquisition as outlined in the Clarke-McNary Act.

A. E. Fivaz,
Secretary.

Second Annual Meeting of California Section

In spite of an unduly long fire season which persisted until a week before the meeting, and in spite of the vagaries of a bull market, finally turned bearish, the second annual meeting of the California Section was highly successful. The attendance was only slightly short of last year's. The papers, covering all the main activities of the national forests, were well prepared and received the close attention of an interested audience. The meeting was in reality the "coming-of-age" party of the national forests. In keeping with this theme, each paper dealt with some national forest activity. Each traced the development of that activity during the past 21 years and concluded with a brief consideration of the relationship of its present status to the future.

Chairman E. I. Kotok, in calling the meeting to order, praised the wisdom of the early forestry leaders of America in providing for decentralized control of the national forests. He also made a plea for greater activity on the part of the Section in the many important problems confronting the profession of forestry. Outstanding among these are the recent

challenge to federal administration of forest and grazing lands, forest education, and industrial forestry. Whether or not the pioneering days of the professional forester are over, the problems are increasing in number and complexity and call for the concerted effort of the Society membership.

The first paper of the day, by S. B. Show, District Forester of the California District, covered the general field of national forest activities. The early struggles to enforce regulations on lands where no such regulations had heretofore existed were recounted. With the adoption of a policy of local control of the federal forest lands there was considerable immediate improvement in administration. Localization of control tended to promote a threshing out of mutual problems on the ground between the forest officers and the forest users. Local authority came to be more respected as is evidenced by the decreasing number of appeals to the central government throughout the years. In spite of the enormous contributions of forest officers to the advancement of technical knowledge, more important is their selling of certain phases of forestry as established practices. Improved forest protection and grazing practice are cases in point. While there have been many disagreements, even these have redounded to the advancement of forestry. A review of the 21 years of activity on the part of the national forests does not reveal the final solution of any one problem, but it does reveal that the national forest enterprise and the larger field of forest conservation are both well established.

The development of the field of silviculture was traced by T. D. Woodbury. Much interesting history was brought out. High commendation was given Show and Dunning for their skillful interpretation of research results for use in the field. Many problems in silvicultural practice, such as that of the disposal of the refuse remaining from cutting, still require solution. However, if sustained yield continues to be the goal and is based on adequately financed research, silviculture will continue to make progress.

Industrial forestry came in for its share of attention. Emanuel Fritz felt rather optimistic about the progress that has been made in spite of a bad lumber market. He made a plea for professional foresters to give this field greater attention and especially to remember that profit in any kind of forestry is dependent on the continued use, by the public, of forest products in large amounts. Swift Berry, of the Michigan-California Lumber Company, thinks that private forestry is in much better shape than most people are willing to admit, and that a company can be practicing forestry without necessarily being on a sustained yield basis.

M. A. Benedict, who handled the subject of fire protection, was much concerned over the continually mounting costs for fire control. He called attention to the immense amount of improvement that is still possible in this field, especially in the mechanical suppression phase. Others felt that with increasing population and consequent increasing timber and watershed values, it is only reasonable to expect that there should be increasing protection costs.

The paper on grazing, by J. W. Nelson, was largely the history of the progress of the livestock industry and its re-

lation to the forage areas. While the stockmen were at first antagonistic to federal control, the damaging of the grazing areas through unrestricted use soon caused them to see its wisdom. The forest officers responsible for range management have contributed a great many things to improved grazing practice.

Research received a very interesting historical treatment by C. L. Hill, who very ably brought out the remarkable development in this field from the disconnected studies of the early days to the well organized forest experiment stations of today.

L. A. Barrett from his long years of close association with the land problems of the forests was able to present a very interesting history of this field. Fraudulent entries are still with us. Legislation is needed which will separate mineral and surface rights. Recreation uses will provide increasing demands and problems in forest management.

Probably no address of the day was more expressive of the spirit of national forest development than the pithy, seriocomic talk by W. G. ("Bill") Durbin which brought the meeting to a close. While couched in humorous terms it very clearly brought out the loyalty and devotion of the old-timers to the cause of forestry and their ability to carry on in spite of the greatest discouragements. Altogether it was a very fitting vehicle of transposition from the more serious papers of the day to the lighter camaradie of the evening banquet.

MYRON KRUEGER,
Secretary.

NORTHERN ROCKY MOUNTAIN SECTION CONSIDERS NATIONAL FOREST POLICY

During February the Northern Rocky Mountain Section gave careful consideration to the majority and minority reports of the Society Committee on Forest Policy at two meetings, through a special committee, and by letter ballot. It appears to be the consensus of opinion of the Section that the majority report does not fully state the gravity of the "situation," and that the remedial measures outlined therein are not adequate. The majority favored Ward Shepard's statement of the "situation," although both the majority and the Pinchot-Ahern reports received support. The Section went on record as favoring a greatly increased federal acquisition program amounting to one hundred million acres. Stabilization of the lumber industry and increased coöperation with private owners were favored, although it is generally felt that the results of coöperative measures have been disappointing.

The majority statement was considered to state the situation regarding the national forests satisfactorily. The definition of the status of Indian lands was not considered satisfactory, the Section favoring stronger measures for re-acquiring allotted lands suitable for timber production and not under proper management. It was not felt that the retention of the Forest Service in the Department of Agriculture should be made a part of the national forest policy.

The majority was against the establishment of a National Forestry Board, and strongly in favor of fixing the responsibility of the states and of private owners. The Section approved Ward

Shepard's substitute for the majority statement regarding public regulation. It went on record as favoring the centralization of all research problems under one major head, including better methods of utilizing timber. The Section endorsed the majority statement regarding public education and the appointment of a temporary Forest Commission.

GEO. M. DEJARNETTE,
Secretary.

INLAND EMPIRE FORESTERS DISCUSS UTILIZATION

At a meeting of the Inland Empire Division of the Northern Rocky Mountain Section in Spokane on January 13, R. L. Bayne, chairman of the Timber Products Bureau of the Spokane Chamber of Commerce, gave an informal talk on "Wood-using Industries of the Inland Empire." He presented the results of a recent survey which showed that within Spokane and the adjoining industrial district on the east 48 manufacturing and selling lumber industries consumed 450,000,000 board feet of lumber per year, of which 110,000,000 feet were sold as waste. This was mostly in the form of sawdust, bog fuel, shavings, and blocks for fuel purposes. The committee of which Mr. Bayne is chairman, is searching for more profitable disposition of this 110,000,000 feet. He also brought out that during the past year six factories in Spokane manufactured more than half of the entire sash and frame output in the United States.

M. I. Bradner of the Products Office of the Forest Service at Missoula next presented a brief summary of the lines of investigation being covered by the Forest Products Laboratory at Madison, together with the associated Products Office of the Forest Service at District headquarters.

J. H. Ramskill of the Forest School of the University of Montana spoke on the utilization studies in progress there; and E. E. Hubert was called on for his views of the problem at hand. A spirited discussion followed the regular program.

Although the attendance was curtailed by the cold weather, about fifty members and friends were present.

W. A. ROCKIE,
Secretary pro tem.

MINNESOTA SECTION ENDORSES KNUTSON BILL

At a special meeting of the Minnesota Section held January 30, 1930, the following resolution was adopted:

Whereas, There has been introduced into the national House of Representatives, by Representative Knutson of Minnesota, a bill known as H. R. 5410 of the 71st Congress, authorizing the Secretary of Agriculture to plant forest trees on an extensive scale in the territory east of the 102d meridian and appropriating therefor various amounts for the fiscal years 1932, 1933, and 1934 culminating in an annual appropriation of $400,000 the last-named and each successive year, which amount might be sufficient to plant between 40,000 and 80,000 acres annually; and

Whereas, There are estimated to be in the states of Minnesota, Wisconsin, and Michigan, exclusive of the states farther east and south, some 12 million acres of potential forest land in need of planting, which it will require 240 years

to replant at the rate of 50,000 acres per annum; and

Whereas, This potential forest land is capable of producing a vast amount of high-grade merchantable timber and is so situated as to be accessible to and of great benefit to the centers of population and industry of the United States, and is not likely for many years to become planted except through the direct or coöperative effort of the federal government: therefore be it

Resolved, By the Minnesota Section of the Society of American Foresters, in meeting assembled this 30th day of January, 1930, that we approve and endorse the Knutson Bill to encourage direct federal forest planting and recommend that it be given thoughtful consideration and encouragement by all public-spirited citizens, and all civic, commercial, and service organizations in this region, and especially by the Congressional delegations of Minnesota, Wisconsin, and Michigan.

Winter Meeting of New York Section

The annual meeting of the New York Section was held in Albany, January 31, 1930. The attendance exceeded by nearly 50 per cent the record for any previous meeting, with about 80 guests, visitors, members of the New York Section on hand. Not only in numbers but in interest this meeting seems to have eclipsed all others.

The following resolution was adopted:

Whereas, the New York Section of the Society of American Foresters has suffered during the past year the loss of two of its most distinguished and long-standing members, at the height of their professional careers, Leigh H. Pennington and F. Franklin Moon, be it

Resolved, That the New York Section of the Society of American Foresters record at this time their expression of deep regret in the loss of these esteemed associates, and their expression of thoughtful appreciation for the valued leadership in the profession of forestry which these men during their time have rendered.

A full program had been planned in advance of the request of the Society that the Section consider the report of the national committee on a forest policy for the United States. The following papers were presented and without exception aroused much interest, as evidenced by the lively discussions, which unfortunately had to be cut short in order to allow time to discuss the national policy:

The Rôle of Disease in the Growing of Poplar, by E. G. Schreiner.

Forest Soil Research in Relation to Forestry, by L. G. Romell.

A Silvicultural Working Plan for Demonstration Forests, by S. O. Heiberg.

R. R. Fenska reported on the Des Moines meeting of the Society.

A portion of the afternoon session was given over to consideration of the New York State reforestation program. N. C. Brown, who is a member of the New York Reforestation Commission, reported that the Commission's ten-year program provides for the purchase and reforestation by the state of 1,000,000 acres in ten years. Under the Hewitt Acts a substantial beginning has been made. Three other members of the Commission, G. F. Warren, A. S. Houghton,

and W. G. Howard, spoke concerning the reforestation program.

The attitude of the New York Section towards the national policy committee report is reflected in two motions which were passed by unanimous vote: (1) That a statement of national forest policy should confine itself to principles; and (2) that the national committee should further address itself to ways and means of enabling the successful practice of private forestry affecting 79 per cent of the present timberland.

In the matter of regulation of the private forest owner, the Section expressed itself as against the recommendations of the committee, the plan proposed by Ward Shepard, and the Pinchot-Ahern proposal. The vote on the Pinchot-Ahern proposal, which is the only one on which an accurate count was secured, was 8 in favor and 28 opposed. The Section expressed itself as against both a temporary forest commission and a permanent central forestry board, and as feeling that further investigation regarding forest devastation is necessary before definite action is taken. It expressed approval of the committee recommendations concerning the proposed program of acquisition, the acceleration of the existing program of coöperation, the five-year finance program for the Forest Service, the proposal to define the status of Indian forest lands, the responsibility of the individual states, the need for new research under both public and corporation auspices concerning the utilization of timber, and better support of educational activities in forestry. The opinion that the national report should be confined to principles means, of course, that the Section does not favor inclusion of these recommendations in a policy statement; but it passed upon them as constituting a desirable federal administrative program.

In view of the crowded schedule of this meeting, and the growing interests of the Section, it was suggested that the Section hold three winter meetings and one field meeting annually. The executive committee of the Section is to consider the advisability of adopting this program.

Newly elected officers of the Section are Arthur S. Hopkins, Chairman; Howard C. Belyea, Secretary-Treasurer; and C. W. Boyce, member of Executive Committee.

J. Nelson Spaeth,
Retiring Secretary-Treasurer.

Announcement of Candidates for Membership

The following names of candidates for membership are referred to Junior Members, Senior Members, and Fellows for comment or protest. The list includes all nominations received since the publication of the list in the February Journal, without question as to eligibility; the names have not been passed upon by the Council. Important information regarding the qualifications of any candidate, which will enable the Council to take final action with a knowledge of essential facts, should be submitted to the undersigned before June 30. Statements on different men should be submitted on different sheets. Communications relating to candidates are considered by the Council as strictly confidential.

FOR ELECTION TO GRADE OF JUNIOR MEMBER

Name and Education	*Title and Address*	*Proposed by*
Baker, Gregory Univ. of Me., B. S. F., 1924	Forester, Diamond Match Co., Biddeford, Me.	New England Sec.
Baker, Robert Marion Washburn Col., 1922-24, Univ. of Colo., 1924-25, Yale, M. F., 1927	Inspector, Fox Park Timber Co., Fox Park, Wyo.	Central Rocky Mt. Sec.
Becton, Wendell R. Univ. of Ga., B. S. F., 1928, Yale, M. F., 1929	Forest Ranger, Rocky Mt. District, Denver, Colo.	Central Rocky Mt. Sec.
Beichler, William K. Pa. State, B. S. F., 1925	District Forester, Western Dist., Asheville, N. Car.	Appalachian Sec.
Birkmaier, Ed. E. Wash. State, B. S. Agr., 1924	Senior Forest Ranger, Wallowa National Forest, Enterprise, Ore.	North Pacific Sec.
Bonebrake, Darrell B. Pa. State, B. S. F., 1929	Asst. Forester, Pa. Dept. Forests & Waters, Waynesboro, Pa.	Allegheny Sec.
Brashears, Murray E. La. State Univ., B. S. F., 1929	Instructor of Forestry, La. State University, Baton Rouge, La.	Gulf States Sec.
Bright, Herbert William N. Y. State, B. S. F., 1928	Cruiser, Wayagamack Pulp & Paper Co., Flamand, Quebec, Canada.	New York Sec.
Burnham, Chester F. Cornell, B. S., 1929	Apprentice, International Paper Co., Fort Edward, New York.	New York Sec.
Carlson, Raymond Pa. State, B. S. F., 1929	Asst. District Forester, McConnellsburg, Pa.	Allegheny Sec.
Cheney, Morton M. George Washington, LL. B.	Asst. District Forester, Albuquerque, New Mexico.	Southwestern Sec.
Flanagan, George C. Univ. of Wash., B. S. F., 1929	Tech. Asst., Mason & Stevens, Portland, Ore.	North Pacific Sec.
Foster, F. R. La. State Univ., B. S. F.	Supt. Pulpwood Cutting, Brown Paper Mill Co., W. Monroe, La.	Gulf States Sec.
Gillett, Paul Taylor Cornell, B. S. Agr.	County Forester, Chautaugua Co., N. Y.	New York Sec.
Glover, Willis H. N. Y. State, B. S. F., 1928	Forester, Oak Hill Country Club, Rochester, N. Y.	New York Sec.
Hedges, W. E. Surveying & Mapping Course in I. C. S.	Acquisition and administrative work, U. S. F. S., Elkins, W. Va.	Allegheny Sec.
Jones, John Davis Univ. of Mont., A. B., 1906, Univ. of Mich., J. D., 1910	Asst. District Forester, Albuquerque, N. Mex.	Southwestern Sec.
Lang, Fred N. Y. State, B. S. F., 1923	Forest Engineer, James D. Lacey & Co., Little Rock, Ark.	New York Sec.
McPherson, Lester J. Ore. Agric. Col., B. S. F., 1929	Forest Ranger, U. S. F. S., Timber Survey, District Office, Portland, Ore.	North Pacific Sec.
Moore, William Leon Univ. of Ga., B. S. F., 1929	Lecturer, Southern For. Ed. Proj., Amer. For. Assn., Thomasville, Ga.	Southeastern Sec.

Name and Education	*Title and Address*	*Proposed by*
Morris, Roger D. Iowa State, B. S. F., 1922	Tech. Asst., Grazing, Tusayan Nat. For., Williams, Ariz.	Southwestern Sec.
Musgrave, Mark E. Short Course, Univ. of Wash. (For.)	Sr. Dist. For. Insp. in charge of Game Man., Phœnix, Ariz.	Southwestern Sec.
Partington, Clyde N. N. H. Univ., 1918-20, Mass. Agr., 1920-22, Ore. State, B. S., 1923	Junior Pathologist, Office of Forest Pathology, Portland, Ore.	North Pacific Sec.
Phillips, Raymond E. N. Y. State	Gen. Supt. and Forester, Monroe Co. Park Com., Rochester, N. Y.	New York Sec.
Scott, James E. Com. Col., Burlington, Vt., 1910	Asst. District Forester, Laconia, N. H.	New England Sec.
Shearer, Frederick W. State Nor., Shippensburg, Pa., Pa. State, B. S. F., 1929	Asst. Forester, Dept. of Forests & Waters, Dry Run, Pa.	Allegheny Sec.
Smith, Edwin F. Business College	Supervisor, Eldorado National Forest, Placerville, Calif.	California Sec.
Space, Jackson W. Univ. of Idaho, B. S. F., 1927	Forest Ranger, Coconino Nat. For., Flagstaff, Ariz.	Southwestern Sec.
Stevens, Daniel Sabine N. Y. State Ranger Sch., 1923	Map drafting, International Paper Co., Crestwood, N. Y.	New York Sec.
Tabbutt, D. W. Univ. of Me., B. S. F., 1922	Junior Forester, U. S. Forest Service, Bennington, Vt.	New England Sec.
Wall, Lloyd Arthur Iowa State, B. S. F., 1920; M. S., 1923	Asst. Range Examiner, Coconino Nat. For., Flagstaff, Ariz.	Southwestern Sec.

FOR ELECTION TO GRADE OF SENIOR MEMBER

Miller, John M. B. S., Stanford Univ., 1908, Grad. work, For. Ent., 1909 (Junior Member 1925)	Senior Entomologist, Stanford Univ., Calif.	California Sec.
Nelson, Jesse W. Normal School, 2 years (Junior Member 1923)	Asst. District Forester, San Francisco, Calif.	California Sec.
Stubbs, Robert Goff Bowdoin Col., B. A., 1909, Yale, M. F., 1913 (Junior Member 1919)	Supervisor, Western Sec., Me. For. Dept., Hallowell, Me.	New England Sec.
Wagar, John V. K. Univ. of Mich., B. S. F., 1920; M. S. F., 1923 (Junior Member 1924)	Asst. Prof., Forestry, Colorado Col., Colorado Springs, Colo.	Central Rocky Mt. Sec.
Williams, Ross A. Montana Univ., B. S. F., 1921, Yale, M. F., 1913 (Junior Member, 1924)	Prof. of Forestry, N. Y. State Ranger School, Wanakena, N. Y.	New York Sec.

FOR ELECTION TO GRADE OF ASSOCIATE MEMBER

Name and Education	*Title and Address*	*Proposed by*
Gilman, H. S. Minnesota University	Superintendent, San Dimas Water Co., San Dimas, Calif.	California Sec.

FOR ELECTION TO GRADE OF CORRESPONDING MEMBER

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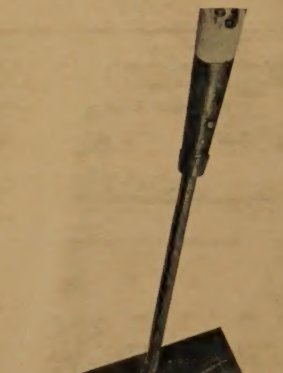

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